SEISMIC SAFETY & SAFETY ELEMENTS

PLACER COUNTY GENERAL PLAN

APRIL 1977

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CHAPTER 1

INTRODUCTION

SEISMIC SAFETY AND SAFETY ELEMENTS

PLACER COUNTY GENERAL PLAN

I. INTRODUCTION

As a result of legislation adopted in 1971, seismic safety and safety elements are now required additions to each County's general plan. Section 65302 of the Government Code states that the seismic safety element shall consist of "an identification and appraisal of seismic hazards such as susceptibility to surface ruptures from faulting, ground shaking, ground failures, or effects of seismically induced waves such as tsunamis and seiches." The seismic safety element shall also include "an appraisal of mudslides, landslides, and slope stability" as geologic hazards.

Section 65302 also states that the safety element should include data for the protection of the community from fires, flooding, and geologic hazards.

The basic intent of this law and, in turn, this document, is to encourage the County to take seismic hazards and other safety considerations into account in the planning process. Consideration will be given to various hazards associated with earthquakes, fires, and flooding in terms of the location of new structures and facilities, criteria utilized in design, and evaluation of existing structures and facilities and the adequacy of existing codes and ordinances. This report will act as a statement of policy and a source of information regarding potential hazards for both advanced and current planning projects. The desired result is to reduce the loss of life, injuries, damage to properties and dislocations resulting from future

fires, floods or seismic disturbances.

Due to the similarity of content required for the seismic safety and safety elements, they have been combined into one document to eliminate duplication of effort.

CHAPTER II

SEISMIC SAFETY

II. SEISMIC SAFETY

A. Summary

Placer County is relatively secure over most of its area from damage and loss due to earthquakes and subsequent seismic occurrences. The County can be considered in three sections as to susceptibility to seismic activity.

The most stable area extends from Roseville to the Donner Summit. This central area is largely formed on ancient granitic and metamorphic rock that contains no historically active faults. Furthermore, it is sufficiently distant from the active faults of the San Francisco Bay area and the Truckee-Carson Valley region so that the impact on the central County area precipitated by major earthquake activities on these faults would be limited to slight to severe ground shaking.

While the area is not known to possess active faults, the 6.1 magnitude earthquake which rocked Oroville on August 1, 1975, testifies that ancient stable faults or an unknown fault can be reactivated through some mechanism. The weight of water or cyclical loading due to drawdown and refilling of a deep reservoir in the vicinity of a fault plain may trigger earthquake activity.

Western Placer County, generally that area west of Roseville and Auburn and including Lincoln, Sheridan, and the Elverta area, is only slightly more susceptible to the effects of distant major earthquakes than the stable central area. Most of this area is underlain by consolidated or cemented sedimentary rocks that react as "bedrock" during an earthquake event. Maximum bedrock accelerations from the maximum credible earthquakes occurring along the San Andreas Fault, 8.5 magnitude, or along the Hayward Fault, 7.5

magnitude, would be less than .1 g. These active faults lie some 85 miles and 70 miles respectively from the southwest corner of Placer County. Current building code requirements require that all new construction meet an earthquake acceleration rate of .1 g. Thus any new construction would not be severely affected by an earthquake of this intensity. A maximum credible earthquake in the Oroville area, approximated at a magnitude of 6.5, would produce maximum bedrock accelerations of .07 g for Sheridan, 35 miles distant, and .04 g for Roseville, some 50 miles from the fault. An earthquake measuring from .04 to .07 would be felt by people indoors and outdoors. Hanging objects indoors would move and dishes would rattle. There would be a likelihood of broken windows and some cracking of poorly constructed masonry. However, for soundly built older housing and any new construction, there would be no structural damage.

As with the central county area, there are no known active faults within this western region. There may, however, be unknown faults occurring in the subsurface sedimentary beds. One such fault was thought to be present in the Linda Creek area of Roseville. It is presently believed that this feature is an inactive fault trace or a linear erosional feature due to Linda Creek. Future detailed geologic work in this western area of the County may delineate additional faults which need to be evaluated.

The U.S. Bureau of Reclamation has currently contracted with consulting engineers to undertake studies of the seismic activity around the Auburn Dam site. The Bureau completed its own extensive geologic and seismic study of the dam site, but after the 1975 Oroville earthquake, it was felt that an independent review should be made of the project to verify their findings. A final report

has not yet been prepared, however, preliminary information indicates no new active earthquake faults in the vicinity of the dam. Thus, as of this writing, officials are optimistic that construction will continue on schedule.

The third, and final area of the County to be discussed, is the Lake Tahoe Basin-Martis Valley area east of the crest of the Sierra Nevadas. This area lies within the active seismic region of eastern California and western Nevada. Epicenters of historic minor earthquakes have occurred within this area of Placer County. However, larger and more frequent earthquake activity has occurred nearby, north of Truckee and in the Carson Valley. A 5.8 magnitude earthquake at Truckee-Boca Dam in 1966 and a 6.0 magnitude earthquake near Verdi, Nevada, in late 1948 are two examples of recent and nearby seismic activities which made themselves felt most assuredly in this eastern region of Placer County.

During the 1966 Truckee earthquake, although there was ground breakage along a zone ten miles long, damage to man-made facilities was largely confined to the effects of ground shaking. Earth cracking and slumps caused damage to Boca and Prosser Dams; minor structural damage occurred on bridges on Interstate 80 which cross the Truckee River; several slumps and landslides occurred in road cuts along I-80 east of Boca Dam; rock slides from steep slopes damaged a powerhouse, flumes, and railroad tracks in the region; water wells were muddied and spring flows increased throughout the Truckee-Russell Valley area. Structural damage from the same earthquake today would be greater due to the recent increase in development in the Martis Valley-Prosser Reservoir areas.

Greater magnitude earthquakes are credible within this area.

A future potential magnitude 7 earthquake originating in the Carson Valley has been projected to cause maximum bedrock accelerations of from .3 to .5 g in the Lake Tahoe area. This level of acceleration could cause structural damage to buildings but not generate enough force to destroy a unit. Maximum credible bedrock accelerations of .3 g in Martis Valley would result from a future maximum credible magnitude 6.5 earthquake in the Stampede Valley Fault. The effects of a shock wave are amplified in unconsolidated surface deposits overlying bedrock. This means that the areas of maximum earthquake severities in terms of both ground shaking and secondary effects such as landslides, rock falls, soil settlement, liquefaction and snow avalances, would be the alluvial deposits of Martis Valley; the lake bed, glacial and stream channel deposits within the valley's tributary to the Truckee River and Lake Tahoe; and the terrace deposits boarding the Truckee River. It should be noted that the severity of the secondary effects noted above will increase with the magnitude and duration of the earthquake. A more detailed analysis of these events will be discussed later in the text.

B. Goal and Policies

GOAL: To protect the lives and property of the citizens of Placer County from unacceptable risk resulting from seismic and geologic hazards.

POLICIES:

1. Maintain strict enforcement of seismic safety standards for new construction contained in the Uniform Building Code.
2. Initiate an active program to eliminate unsafe and hazardous structures through a comprehensive survey of building to determine susceptibility to seismic damage.
3. Review future developments using all available seismic data and taking into account recommendations from the seismic safety element.
4. Encourage the use of seismic safety element data in the preparation of future environmental impact reports.
5. Require studies to be prepared to determine the exact area of a fault zone prior to permitting construction of major structures in the immediate vicinity of a fault.
6. Cooperate with and encourage federal, state, and other local jurisdictions to research seismic hazards and develop programs to mitigate hazards.
7. Pursue adoption of a grading ordinance in the western portion of the County as per the Lake Tahoe area.
8. Require soils or geologic reports for construction or extensive grading in potential seismic problem areas.
9. Review existing Emergency Services Plan to insure adequacy in handling seismic occurrences.

10. Review other elements of the Placer County General Plan to assure consistency with the goal and policies of this element.

C. <u>Definition of Terms</u>

FAULT: A plane or surface in the earth's surface along which failure has occurred and materials on opposite sides have moved relative to one another in response to the accumulation of stress in the underlying earth.

ACTIVE FAULT: A fault that has moved in recent geologic time and which is likely to move again in the relatively near future. (For geologic purposes, there are no precise units to recency of movement which define an "active fault." Definitions for planning purposes extend on the order of 10,000 years or more back and 100 years or more forward if not otherwise noted.)

INACTIVE FAULT: A fault which shows no evidence of movement in recent geologic time and no evidence of potential movement in the relatively near future.

SEISMIC HAZARDS: Hazards related to seismic or earthquake activity.

GROUND FAILURES: Include mudslides, landslides, liquefaction, and subsidence (ground slump).

TSUNAMIS: Seismically induced sea waves, often called "tidal waves."

SEICHES: Waves in lakes and reservoirs due to tilting or displacement of the bottom or shoreline.

MAXIMUM CREDIBLE EARTHQUAKE: The maximum earthquake that appears capable of ever occurring on a given fault under the present geologic framework.

MAXIMUM CREDIBLE BEDROCK ACCELERATION: The maximum bedrock acceleration at the site that appears credible by relating the maximum credible earthquake on a given fault to the distance from the site.

D. Geologic History of Placer County

1. Regional Physiography

Placer County includes portions of two of the major physiographic provinces of California: the Sacramento Valley and the Sierra Nevada. The Sacramento Valley portion of the County begins about 7 miles east of the Sacramento River and extends about 9 miles to a line that runs through Roseville, Lincoln, and a point about 4 miles east of Sheridan. The entire area is a relatively treeless plain that slopes gently westward toward the river. Several streams with narrow floodplains entrenched from 10 to 20 feet below the surrounding plain drain the area flowing east to west. The major annual streams are Dry Creek, which flows into Sacramento County, Pleasant Grove Creek, Auburn Ravine, and Coon Creek. Bear River forms the northern boundary of the County with Yuba County.

The foothills of the Sierra Nevada begin at the eastern limit of the Sacramento Valley. Along the central axis of the County it is approximately 60 miles in a northeast direction to the crest of the Sierra Nevada which attains an elevation of about 9,000 feet. The Sierra Nevada comprises a gently sloping fault block that was uplifted at the east slope along a series of interconnected fault segments. The upper surface of the Sierra Nevada was a relatively planar peneplain, extensively eroded and leveled prior to the uplift. Subsequent to the major uplift, the Rubicon River, the Middle and North Forks of the American River, the Bear River, and the Yuba River have incised deep V-shaped canyons from 1,000 to 2,000 feet below the original erosion surface which exists only as remnants today. Canyon slopes adjacent to the rivers and

tributaries are very steep which indicate the rapid nature of the down-cutting. The rivers drain generally southwest. Over most of the High Sierra, the rivers run normal to the major metamorphic structure which trends west-of-north to east-of-south. However, in the lower reaches the rivers alternate between running along the metamorphic structure and cutting across the structure.

East of the crest of the Sierra Nevada there is an abrupt drop into the Lake Tahoe Basin in the southern part of the County and Martis Valley in the northern part of the County. A volcanic highlands area which includes Mount Pluto (8,617) and Martis Peak (8,712) intervenes between the two low areas. This area of eastern Placer County is structurally similar to the Basin and Range physiographic province of Nevada, with mountains and ranges that have been uplifted along boundar faults above the adjacent valleys. Lake Tahoe occupies a basin that formed along two north-south boundary faults. However, the actual eastern edge of the Sierra Nevada province is about 10 miles east of the state line in Nevada.

Lake Tahoe is drained by the Truckee River which flows north to Truckee in Nevada County and then east into Nevada. Tributaries from east of the crest of the Sierra Nevada flow down narrow glacier-carved valleys, the most famous of which is Squaw Valley, into the Truckee.

2. Rock Units

Placer County contains examples of all rock types: metamorphic, granitic, volcanic, and sedimentary. Overlying these ancient "bedrock" units are young, unconsolidated surficial deposits formed by stream, lake, glacial, mass wasting, and volcanic processes. Exhibits 1 and 2 provide a summary of the

geologic history of Placer County (Jenkins, 1948).

EXHIBIT 1

Geologic history of Placer County (Jenkins, 1948).

Geologic era	Geologic period		Geologic event	Geologic record	Duration in millions of years	
						Age
Cenozoic	Quaternary	Recent	History of man Quartz mining Placer mining Dredging Hydraulic mining Shallow, hand placering	Historical record 2¼ billion dollars gold produced	1	
		Pleistocene	Resurrection of ancient channels and old Tertiary surfaces Continued faulting Glaciation Canyon cutting, robbing gold from earlier Eocene channels Uplift and faulting	Physiographic features Rock exposures Gravel deposits		1–2
	Tertiary	Pliocene	Continued basic volcanic activity Uplift and faulting Intervolcanic streams Andesitic flows, concealing old surface	Mehrten formation (andesite) ——?——	7	8
		Miocene	Andesitic lavas, breccias, ash, mud flows, covering all but the higher peaks and ranges Ash falls, covering surfaces	Valley Springs formation (rhyolite)	12	20
		Oligocene	Rhyolitic ash falls dam streams, covering channels.		16	36
		Eocene Paleocene	Deposition of large stream deposits of white quartz gravel (angular and subangular) and placer gold Deposition of Ione clay, lignite, and sand (in part marine) Release of gold from rocks and veins Decay of rocks, formation of deep red soil Semi-tropical weathering	Ancient channels Ione formation Ancient channels Old surfaces Deep red soil	23	60
Mesozoic	Upper Cretaceous		Pirate streams rob east-flowing streams, cutting the Pre-Tertiary Divide and Great Western Divide Tops of gold-bearing veins reached by erosion Deposition of sand and gravel in basin west of Sierra Nevada Erosion and removal of rocks 2 miles thick from top of Sierra	Chico formation Conglomerates, sandstones, and shales many miles in thickness (Great Valley)	35	95
			Profound unconformity			

EXHIBIT 2

Geologic history of Placer County, cont.

Geologic era	Geologic period	Geologic event	Geologic record	Duration in millions of years	Age
		Profound unconformity			Age
Mesozoic	Upper Jurassic	Nevadan orogeny: Infiltration of mineral-bearing quartz veins into fractured rocks	Quartz veins		
		Nevadan orogeny: Metamorphism of older rocks on contact with granitic rocks	Granodiorite and related rocks		
		Nevadan orogeny: Intrusion of granitic batholith	Dike rocks		
		Nevadan orogeny: Folding, crushing and faulting	Serpentine	40	
		Nevadan orogeny: Uprise of sediments from inland sea basin	Mariposa slate		
		Intrusions of serpentine rocks	Amador volcanic group		
		Interbedding of basalt with sediments	Agua Fria formation		
		Marine deposition	Logtown Ridge and Penon Blanco formation		
		Volcanism	Cosumnes and Hunter Valley formations		
	Lower Jurassic	Marine deposition			155
	Triassic	Marine deposition, including coral reefs	Sailor Canyon formation		
			Brock shale	35	
		Volcanism	Hosselkus limestone		
			Volcanic rocks		190
		Folding and unconformity			
Paleozoic	Carboniferous and Permian	Marine deposition, including coral reefs	Calaveras formation including limestones: Clipper Gap formation		
		Extensive sedimentation throughout Sierra Nevada province	Delhi formation		
			Cape Horn slate		
			Relief quartzite	300	
			Kanaka conglomerate formation		
			Tightner volcanic formation		
			Blue Canyon marine formation		
	Devonian	Marine deposition			
	Silurian	Marine deposition, including coral reefs			
	Ordovician Cambrian	Not known in Sierra Nevada			500
Pre-Cambrian		Not known in Sierra Nevada		Indefinite 1300	2 billion (age of earth)

3. History of Faulting

There are no known active faults within Placer County and there are no faults known to have been active during historic times. However, there are active earthquake-producing faults north and east of Placer County. In addition, hot springs and scarps at Brockway near the state line and in the Carson Valley of Nevada indicate relatively recent faults. Exhibit 3 illustrates the known faults and earthquake epicenters in Placer County and the surrounding region. Fault and earthquake activity will continue in the basin-range area of the eastern Sierra Nevada. Activity as evidenced by the historic record will be sporadic and at random locations as stress accumulates along various portions of faults in the region around Lake Tahoe. It appears more probable that active faulting will occur along an "inactive" or "potentially active" fault segment in the area than along one where the stress recently has been relieved.

The fault history of Placer County began about 140 million years ago with the folding, crushing, and faulting of marine sedimentary and volcanic deposits. Additional faulting may have occurred as serpentines were intruded within the area between the Melones Fault and the Bear Mountain Fault.

The intrusion of granite masses into the folded metamorphic rocks appears to have caused a regional compression. The metamorphic rocks are cut by numerous moderate angle reverse shear zones. The larger and more continuous of these contain quartz veins which appears to indicate a connection to the granitic masses. Offsets range from a few feet to a few hundred feet.

There are no faults that cut across the isolated masses of

granite of the central Sierra Nevada. There are some shear zones containing quartz veins of local extent. The major vertical faults within the metamorphic rock terminate at the borders of the granitic bodies. This is evidence that those faults became inactive during or before the intrusion of granite and have since remained in that state.

The period of granitic intrusion ranged from 136 million years ago in the vicinity of Loomis to about 90 million years ago in the High Sierra. The entire region was uplifted probably several thousand feet during that time. The Sierra Nevada was still connected with western Nevada although there probably was extensive fault activity east of the uplifted region.

For the next period of about 60 to 70 million years there was relative stability over the uplifted region, except that uplift may have continued at some slow rate. The area was eroded to great depths and a relatively planar gently sloping surface was formed. Extensive deposits of white quartz gravels containing placer gold formed in the wide river channels of the ancestral American and other rivers north and south of Placer County. Sedimentary deposits of the Chico and Ione Formations formed during this period.

The rhyolite tuff beds in the Valley Springs Formation at Alta and Rocklin indicate the commencement of explosive volcanic activity in western Nevada. Fault activity probably occurred concurrently over the area of volcanism as Nevada began to break into distinct basins and ranges. Volcanic mudflow breccias of the Mehrten Formation flowed from vents in western Nevada to the Sacramento Valley probably covering the entire pre-volcanic

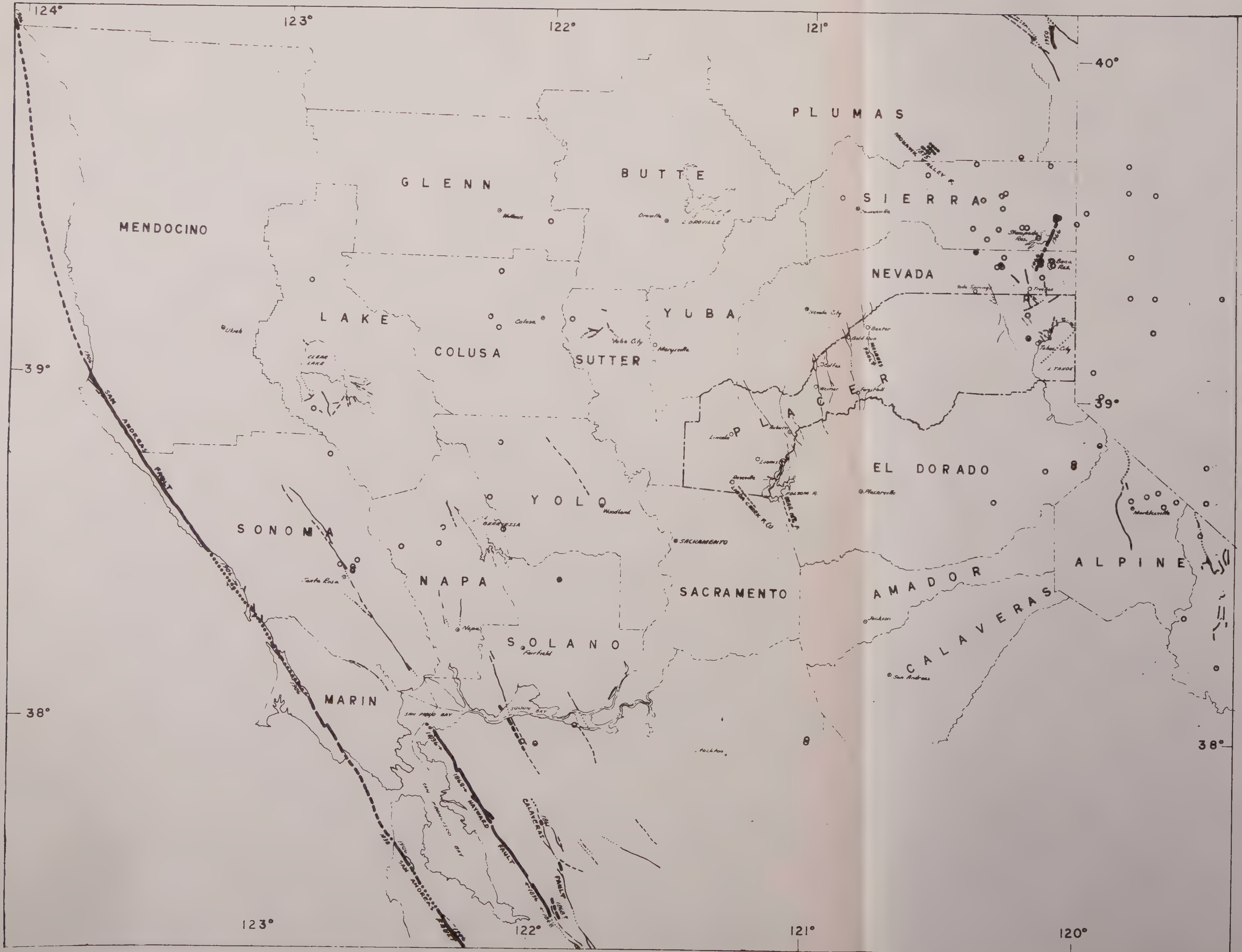


EXHIBIT 3

FAULT AND EARTHQUAKE EPICENTER MAP OF PLACER COUNTY, CALIFORNIA

AND SURROUNDING REGION

Portion of

GEOLOGIC SEISMIC SAFETY ELEMENT

of

PLACER COUNTY, CALIFORNIA

SCALE 1:750,000

[illegible]

CLASSIFICATION OF FAULTS

ACTIVE FAULT, movement recorded during historic time (approximately during last 200 years). Date of most recent ground rupture is indicated. Dashed where approximate, dotted where concealed.

POTENTIALLY ACTIVE FAULT, movement indicated during Quaternary Period (last 2 million years), no movement known during historic period.

INACTIVE FAULT, movement indicated during Pre-Quaternary [illegible] years), [illegible] recent movement. NOTE: these faults are shown only within the borders of Placer County, not for other counties).

EXPLANATION OF EARTHQUAKE EPICENTERS
(RECORD: 1934-19[illegible])

○	MAGNITUDE	4.0 - 4.9
◒	MAGNITUDE	5.0 - 5.9
●	MAGNITUDE	6.0 - 6.9
■	MAGNITUDE	7.0 - 7.9
▲	MAGNITUDE	[illegible]

REFERENCES SOURCES

1. California Div. of Mines and Geology, "State of California, Preliminary Fault and Geologic Map", 1973.
2. California Dept. of Water Resources Bull. 116-2, "Crustal Strain and Fault Movement Investigation", [illegible].
3. ESSA, U.S. Coast and Geodetic Survey, "Preliminary Determination of Epicenters", [illegible].
4. California Div. of Mines and Geology, "Geologic [illegible] of California", [illegible] Sheet [illegible] and [illegible] Sheet [illegible], Scale 1:250,000.

NOTE TO USERS OF THIS MAP DATA. Faults shown on this map do not preclude the existence of other active faults in the area and epicenters [illegible] magnitude.

PREPARED FOR PLACER COUNTY PLANNING DEPARTMENT

[illegible]

landscape. The volcanic rocks in the vicinity of Donner Pass range in age from 2.6 to 7.4 million years (Burnett, 1968). The youngest deposit exposed at Crystal Peak and Boreal Ridge is a thin basalt flow that originated from a vent in the vicinity of Truckee. Presumably, the eastern Sierra Nevada fault system became activated between about 2 and 2.5 million years ago. South of Lake Tahoe there is but a single crest dividing the gentle western slope from the steep eastern scarp. The crest divides in El Dorado County south of Lake Tahoe. The major crest trends northwest to Donner Pass and the other trends north to form the Carson Range between Lake Tahoe and the Carson Valley of Nevada. Lake Tahoe occupies the central low area between the two uplifted crests. The elevation of the floor of the lake is 4,700 feet, which is the same as the Carson Valley.

Therefore, the main frontal fault of the Sierra Nevada occurs in Nevada about 6 miles east of Lake Tahoe. Distinct scarps and hot springs along the mountain front in Jacks Valley and near Genoa indicate that the fault remains potentially active. The east side of the Lake Tahoe Basin also is of fault origin. The fault appears to run north-south along Stateline Point in Nevada where it separates volcanic rocks on the east from adjacent granitic rocks on the west. Hot springs at Brockway may originate from this fault. A projection of this fault to the north would connect with the active Grizzly Valley Fault.

The west side of Lake Tahoe appears to be a scarp formed by a fault that extends south along Carnelian Bay past Dollar Point. This fault has been mapped only a short distance north due to forest cover. However, it lines up with a suspected fault along

the east side of Martis Valley and could explain the rather steep east slope of Mount Pluto if a connection exists between the two areas. On the basis of underwater contours this fault extends due south from Dollar Point to Emerald Bay and crosses the Placer-El Dorado line about one mile east of Sugar Pine Point.

At that same point, it is thought that the main fault of the west crest of the Sierra branches off to the northwest. This inner crest of the Sierra Nevada has been uplifted along numerous short curved fault segments that apparently connect together rather than a single continuous well-marked fault. The location of the fault in northern Placer County is near the west end of Donner Lake and the west end of Squaw Valley. The fault trace has not been mapped south of Squaw Valley because of extensive glacial moraine. However, there appears to be some topographic and geometric evidence that the fault curves abruptly east at Squaw Valley for about one mile then curves southeast across a saddle toward the Truckee River. It would cross Bear Creek about 1/4 mile west of the river and connect with a possible fault scarp at the east end of an andesite lava flow near the Truckee River. From that point the fault line could trace southeast along the west side of a cinder cone then under the glacial moraine of Paige Meadow and immediately west of the community of Sunnyside. From there the fault line would trace southeast into Lake Tahoe and then curve south to join the fault trending south from Dollar Point. There are no known hot springs along this western system of faults as there are along the east crest.

Extensive volcanic activity appears to have gone on within the Lake Tahoe Basin during and subsequent to the uplift of the

flanking crests. The Truckee River has continued to cut its way north through and around lava flows although it is possible that the course of the river has been forced to the west by uplift and volcanic activity in the highlands area north of the lake.

The older lake terrace deposits exposed west of Tahoe City indicate uplift and fault activity in the area after their deposition by the easterly dip of the beds. The age of an overlying lava flow has been dated at 2 million years (Burnett, 1968).

The age of the last major faulting along the Sierra Nevada crest faults is not known with certainty. However, the faults do not cut Tahoe stage glacial moraine in the vicinity of Squaw Valley and may well be preglacial (Hudson, 1948). The age of the start of glaciation is not as yet established. Probably glaciers would have begun to form when the Sierra attained an elevation sufficient to support a permanent snowpack. This means the pre-Tahoe stage may have started between 1 and 2 million years ago.

Faulting during the past 2 million years appears to have mainly taken place on small fault segments within the basin area. This would be associated with the uplift of small ranges and the intrusion of volcanic material into older lava flows from which volcanoes and younger lava flows could form. The last episode of this type activity is represented by the cinder cones in the volcanic highlands between Lake Tahoe and Truckee. The sporadic fault activity and accompanying earthquakes continue to the present time. Because of the short duration of the historic earthquake record, it is impossible to determine whether the frequency and intensity of earthquakes is decreasing in the area. Also the record is too limited to determine which fault segments

are the most active with any accuracy. Exhibit 4 illustrates the present geologic framework of the Sacramento Valley, the Sierra Nevada, and the Basin-Range of western Nevada.

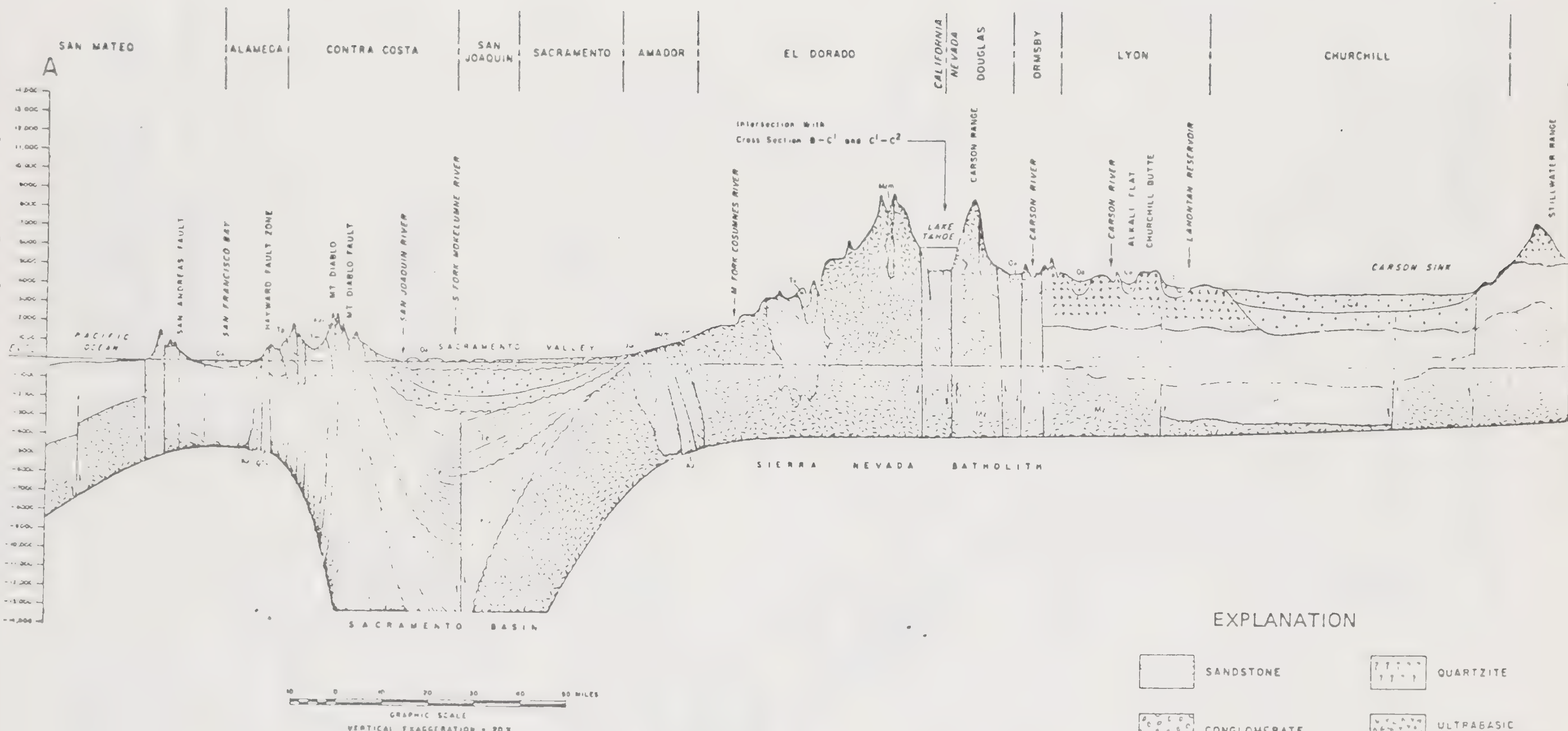
4. Historic Earthquakes.

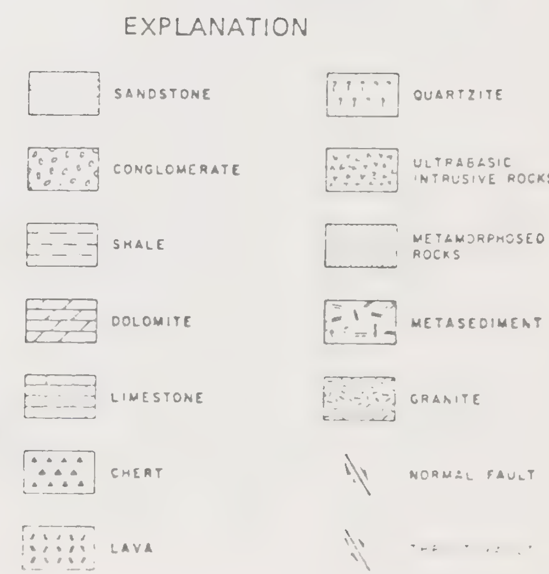
Epicenters of earthquakes that have occurred within 50 miles of eastern Placer County are shown on Exhibit 5. A catalog of earthquakes with magnitudes greater than 3.9 is provided in Appendix A. Before 1934, there were poor instrumental determinations of epicenters for this area, so the magnitude and location are approximate.

Three major earthquakes probably occurred within the surrounding region during historic times: 1852, 1860, and 1869. The 1852 earthquake centered near Pyramid Lake. However, there is some possibility that another occurred on the west side of Carson Valley at about the same time and triggered the large landslide at Slide Mountain and formed the young scarp at the base of the Carson Range (Greensfelder, 1968). The intensity IX (MM Scale) earthquakes of 1860 and 1869 were centered in the Carson City-Virginia City area. These large earthquakes probably produced intensities of VII or VIII in eastern Placer County (Greensfelder, 1968).

An additional five earthquakes with magnitudes ranging between 5.5 and 6.0 occurred within the surrounding region between 1869 and 1966. They probably produced intensities ranging from VI to VIII in the area between Truckee and Lake Tahoe.

EXHIBIT 4 - Geologic cross section of California and Nevada.





GEOLOGICAL CROSS SECTION OF CALIFORNIA AND WESTERN PORTION OF NEVADA

REF: American Association of Petroleum Geologists, 1968, Geological highway map, Pacific Southwest Region, California—Nevada. American Association of Petroleum Geologists, Tulsa, Oklahoma.

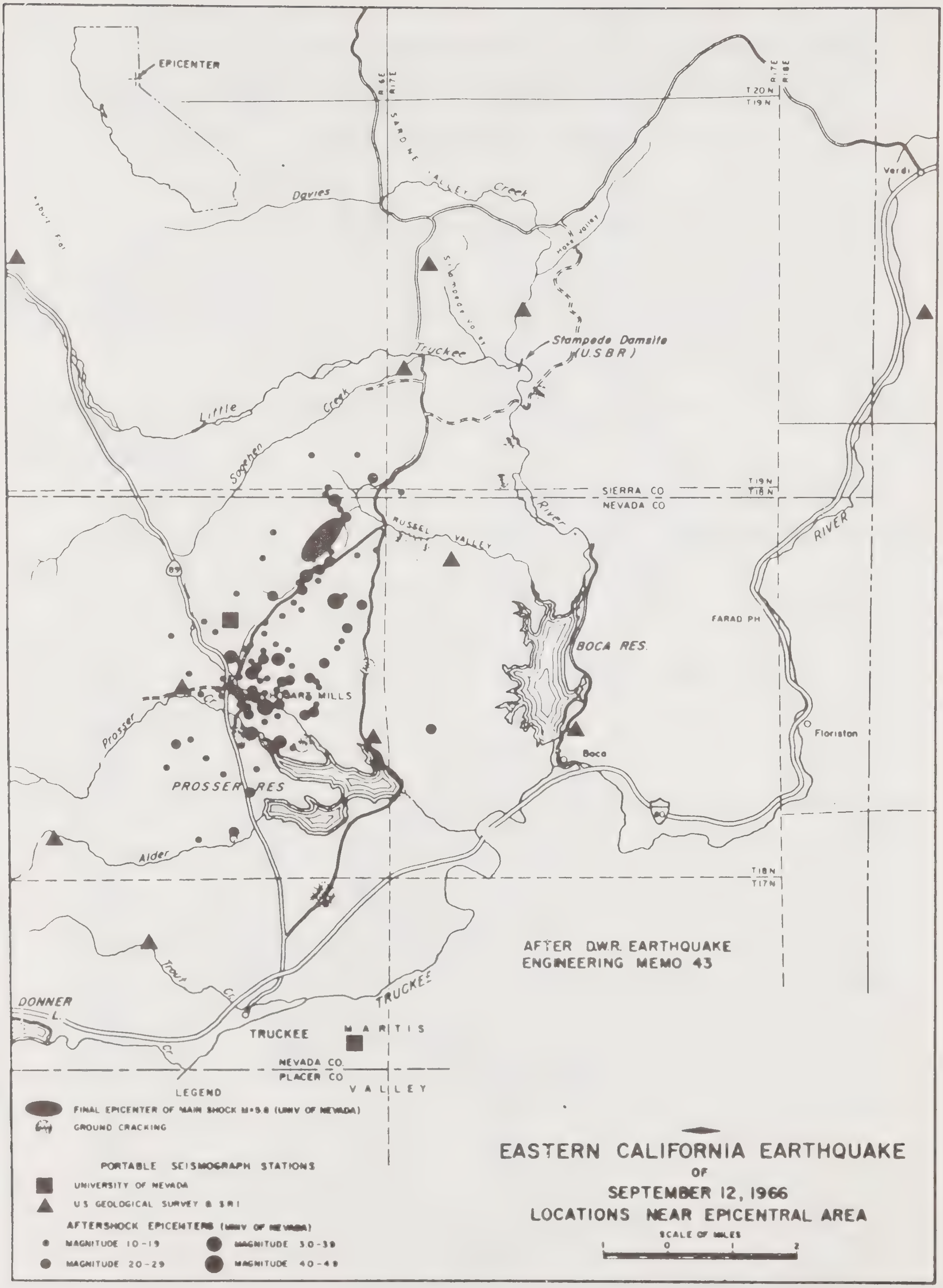


EXHIBIT 5

Map of Truckee earthquake, September 12, 1966.

E. Seismic Hazards in Placer County

1. What Causes Earthquakes?

Earthquakes are the result of underground forces acting on crustal material. Recent studies have concluded that the earth's surface is composed of a number of plates which "float" on subsurface rock units. As these rock units shift in response to tectonic forces, shifts in the floating plates occur. The frequency of earthquakes is the greatest where two plates are being pushed against one another or where one plate is overriding another.

The American Plate includes both North and South America. The San Andreas Fault is a part of the western boundary of the American Plate. The crustal material west of the San Andreas Fault is part of the Pacific Plate, which is moving to the northwest. The stress is built up in the rocks as these plates are pushed against one another until the strength of the rock is exceeded and the result is an earthquake.

California's position with respect to the Pacific and American Plates assures the occurrence of future earthquakes as the crust adjusts itself to changing stresses.

2. Measuring Earthquakes

To put into common terminology the force created by an earthquake is indeed a difficult task. To merely comprehend the forces generated stretches the imagination. The energy generated by the San Francisco earthquake of 1906, the largest on record ever to hit the state, has been compared to the force needed to raise a cubic mile of rock 6,000 feet in the air, or to run a battleship at full speed for 45,000 years. Measurement of force in such terms, however, is only hypothetical and, while interesting, it

is not adequate for our purposes.

Earthquakes can be measured in terms of either energy (magnitude) or actual effect (intensity). The former measurement is based on instrument records, the latter is based on personal observations. These two measurements are completely separate attempts to quantify the force of an earthquake and should be considered as separate in intent and result. An earthquake which occurs, for example, in a densely populated urban area and causes extensive injuries and destruction to property, may have exactly the same magnitude as an earthquake occurring in an unpopulated area which does little more than scare a few jackrabbits.

a. The Richter Magnitude Scale

While the Richter scale was first used in 1935, previous records allowed the assignments of magnitudes of major earthquakes to 1904.

Magnitudes are expressed as whole numbers and decimals ranging from 1.0 to 10.0, from lowest force to greatest. The majority of readings fall between 3 and 8. The maximum amplitude of earthquake waves are recorded on a seismogram and transformed to numerical figures by means of a logarithmic scale. A jump of one whole number per the Richter Scale represents a ten-fold increase in the size of the earthquake record. For example, the record written by an earthquake of 8 is not twice that of a shock of a 4 magnitude; rather it is 10,000 times as great. Exhibit 6 will help to illustrate the energy employed at various earthquake levels.

EXHIBIT 6

ENERGIES OF EARTHQUAKES

Earthquake Magnitude	Approximate Earthquake Energy
1.0	6 ounces TNT
1.5	2 pounds TNT
2.0	13 pounds TNT
2.5	63 pounds TNT
3.0	397 pounds TNT
3.5	1,990 pounds TNT
4.0	6 tons TNT
4.5	32 tons TNT
5.0	199 tons TNT
5.5	1,000 tons TNT
6.0	6,270 tons TNT
6.5	31,550 tons TNT
7.0	199,000 tons TNT
7.5	1,000,000 tons TNT
8.0	6,270,000 tons TNT
8.5	31,550,000 tons TNT
9.0	199,000,000 tons TNT

While the Richter Scale has no maximum limit, the largest known earthquakes in the world have not surpassed the 8.9 magnitude.

b. Mercali Earthquake Intensity Scale

Following an earthquake, seismic experts will conduct a field survey usually through a mailed questionnaire, requesting people within the affected area to relate their impressions, what they saw and what they felt during the earthquake. After compiling the data, the experts will decide which of the 12 degrees of intensity of the Modified Mercali Scale would best apply to specific places within the earthquake impact area; the figure determined is then placed on a map. Once a significant number of such determinations and entries are made, lines connecting equal intensities are drawn on the map. These lines, which generally form a series of closed concentric curves, are called isoseismal

lines. Within the innermost of these lines, the epicenter of the earthquake will be situated.

Intensity ratings are based on observation not on instrument measurements. Herein lies the shortcoming of this scale -- the human input required. Persons may not be able to give a clear account of what they experienced; their impressions may be biased by emotional stress produced at the moment of the quake. Exhibit 7 illustrates the classification system used in the Mercali Intensity Scale. Exhibit 8 explains the maximum expectable earthquake intensity in California.

3. Earthquake Hazards in Placer County

Eastern Placer County is an area of moderate earthquake hazard. According to predicted ground accelerations from maximum credible earthquakes in northern California and western Nevada, the area of Placer County east of Donner Summit is susceptible to major damage from future earthquakes. Active faults are unknown within the area, however, they occur to both north and east. There are numerous faults and shear zones within the volcanic rocks of the area between Lake Tahoe and Truckee that have been active within the past 2 million years, as illustrated in Exhibit 9. These faults need to be considered potentially active. The history of the region indicates that many of the moderate earthquakes have occurred along fault segments that were unknown or considered inactive. The Truckee earthquake of September, 1966, appears to have occurred along a fault that was previously unknown due to alluvial cover over its length.

Placer County west of the inner crest of the Sierra Nevada is generally considered stable and subject to only minor damage from

THE MERCALLI INTENSITY SCALE

(As modified by Charles F. Richter in 1956 and rearranged)

If most of these effects are observed	*then the intensity is:*
Earthquake shaking not felt. But people may observe marginal effects of large distance earthquakes without identifying these effects as earthquake-caused. Among them: trees, structures, liquids, bodies of water sway slowly, or doors swing slowly.	I
Effect on people: Shaking felt by those at rest, especially if they are indoors, and by those on upper floors.	II
Effect on people: Felt by most people indoors. Some can estimate duration of shaking. But many may not recognize shaking of building as caused by an earthquake; the shaking is like that caused by the passing of light trucks.	III
Other effects: Hanging objects swing. *Structural effects:* Windows or doors rattle. Wooden walls and frames creak.	IV
Effect on people: Felt by everyone indoors. Many estimate duration of shaking. But they still may not recognize it as caused by an earthquake. The shaking is like that caused by the passing of heavy trucks, though sometimes, instead, people may feel the sensation of a jolt, as if a heavy ball had struck the walls. *Other effects:* Hanging objects swing. Standing autos rock. Crockery clashes, dishes rattle or glasses clink. *Structural effects:* Doors close, open or swing. Windows rattle.	V
Effect on people: Felt by everyone indoors and by most people outdoors. Many now estimate not only the duration of shaking but also its direction and have no doubt as to its cause. Sleepers wakened. *Other effects:* Hanging objects swing. Shutters or pictures move. Pendulum clocks stop, start or change rate. Standing autos rock. Crockery clashes, dishes rattle or glasses clink. Liquids disturbed, some spilled. Small unstable objects displaced or upset. *Structural effects:* Weak plaster and Masonry D* crack. Windows break. Doors close, open or swing.	VI
Effect on people: Felt by everyone. Many are frightened and run outdoors. People walk unsteadily. *Other effects:* Small church or school bells ring. Pictures thrown off walls, knicknacks and books off shelves. Dishes or glasses broken. Furniture moved or overturned. Trees, bushes shaken visibly, or heard to rustle. *Structural effects:* Masonry D* damaged, some cracks in Masonry C*. Weak chimneys break at roof line. Plaster, loose bricks, stones, tiles, cornices, unbraced parapets and architectural ornaments fall. Concrete irrigation ditches damaged.	VII
Effect on people: Difficult to stand. Shaking noticed by auto drivers. *Other effects:* Waves on ponds; water turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Furniture broken. Hanging objects quiver. *Structural effects:* Masonry D* heavily damaged; Masonry C* damaged, partially collapses in some cases; some damage to Masonry B*; none to Masonry A*. Stucco and some masonry walls fall. Chimneys, factory stacks, monuments, towers, elevated tanks twist or fall. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off.	VIII
Effect on people: General fright. People thrown to ground. *Other effects:* Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes. Steering of autos affected. Branches broken from trees. *Structural effects:* Masonry D* destroyed; Masonry C* heavily damaged, sometimes with complete collapse. Masonry B* is seriously damaged. General damage to foundations. Frame structures, if not bolted, shifted off foundations. Frames racked. Reservoirs seriously damaged. Underground pipes broken.	IX
Effect on people: General Panic. *Other effects:* Conspicuous cracks in ground. In areas of soft ground, sand is ejected through holes and piles up into a small crater, and, in muddy areas, water fountains are formed. *Structural effects:* Most masonry and frame structures destroyed along with their foundations. Some well built wooden structures and bridges destroyed. Serious damage to dams, dikes and embankments. Railroads bent slightly.	X
Effect on people: General panic. *Other effects:* Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. *Structural effects:* General destruction of buildings. Underground pipelines completely out of service. Railroads bent greatly.	XI
Effect on people: General panic. *Other effects:* Same as for Intensity X. *Structural effects:* Damage nearly total, the ultimate catastrophe. *Other effects:* Large rock masses displaced. Lines of sight and level distorted. Objects thrown into air.	XII

*Masonry A: Good workmanship and mortar, reinforced, designed to resist lateral forces.
Masonry B: Good workmanship and mortar, reinforced.
Masonry C: Good workmanship and mortar, unreinforced.
Masonry D: Poor workmanship and mortar and weak materials, like adobe.

EXHIBIT 7

Modified Mercalli Scale of earthquake intensities. (from Alfors, et al, 1973).

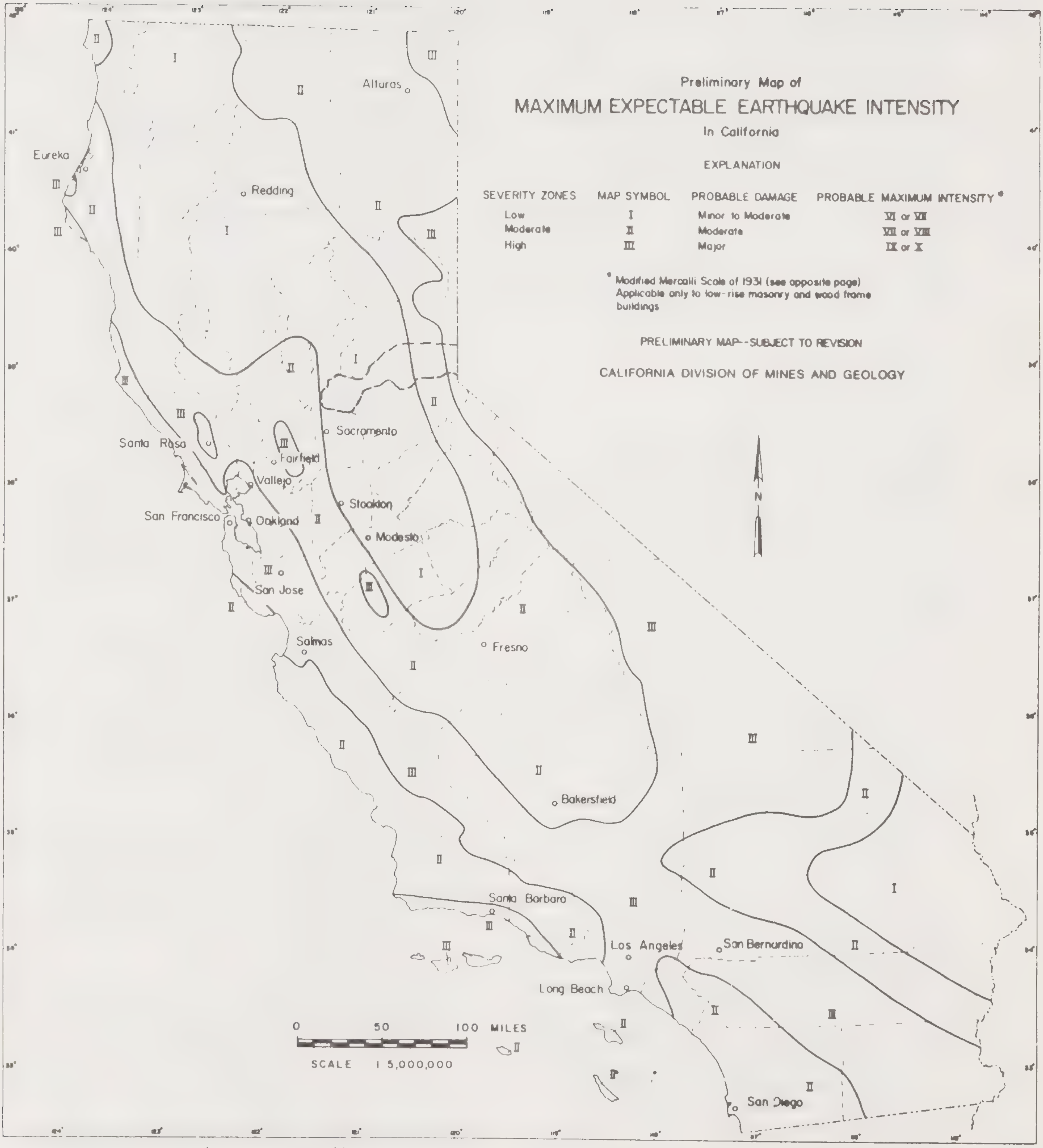


EXHIBIT 8

Maximum expectable earthquake intensity in California (Alfors, et al, 1973).

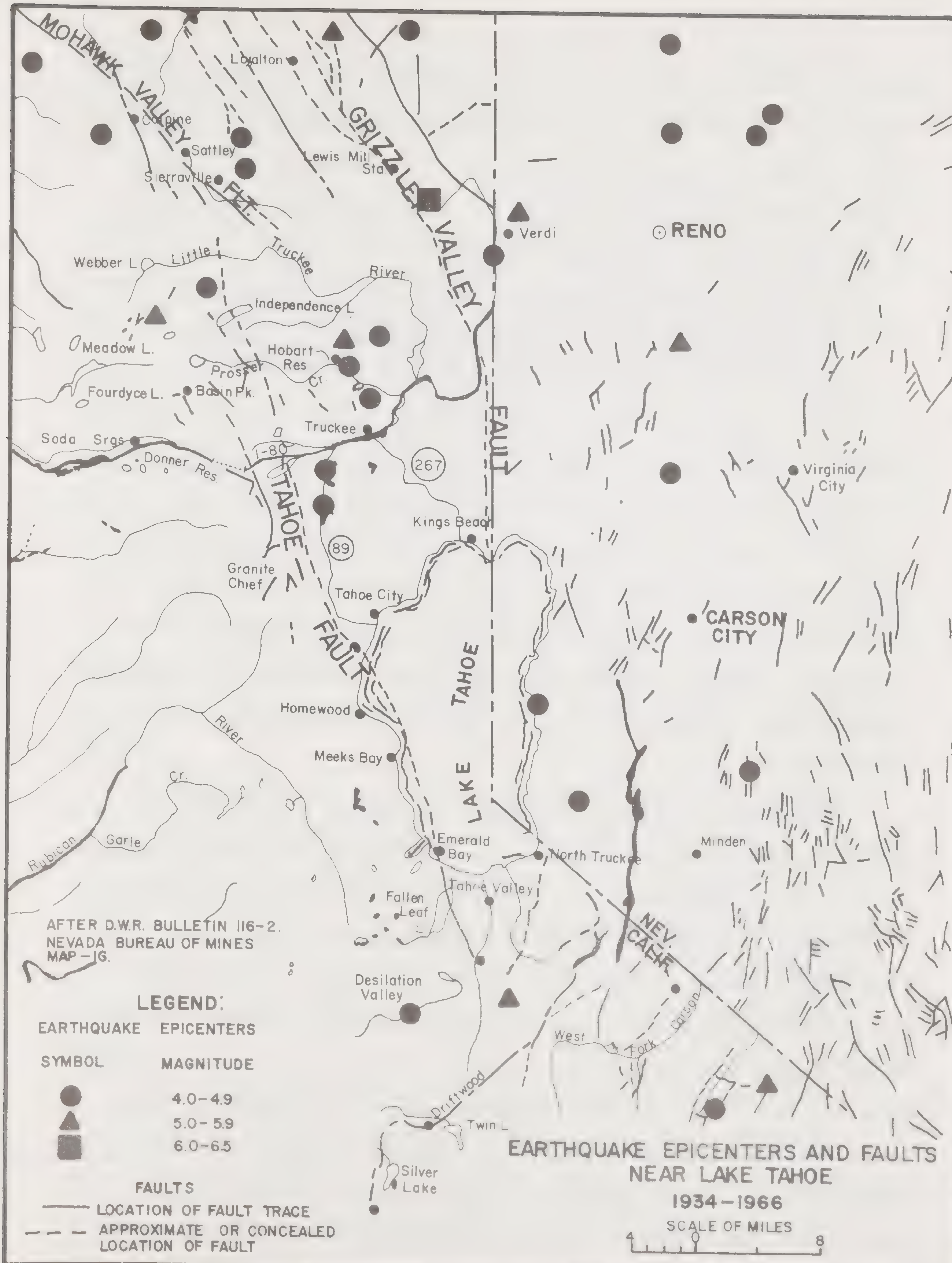


EXHIBIT 9 - Earthquake epicenters and faults near Lake Tahoe (Burnett, 1968).

major earthquakes in the San Francisco Bay area or Truckee-Carson Valley area. However, the magnitude 6.1 earthquake on August 1, 1975, centered several miles south of Oroville indicates that closer earthquake events need to be considered for construction design purposes in this area. Rogers (1975) states,

> "Probably the most important lesson to be learned from this (Oroville) earthquake is that magnitude 6 or greater earthquakes could occur anywhere in the foothills of the Sierra Nevada, even though the overall seismicity of the area is low."

It is considered improbable that any of the faults within the granitic and metamorphic rocks of Placer County will become reactivated unless it is by an external agent such as a deep reservoir. However, unknown faults within the sedimentary rock units in the Sacramento Valley portion of Placer County may become unexpectedly active as did the fault near Oroville. Triggering mechanisms from external agents could be the pumping-out of large quantities of ground water or the pumping-in of large quantities of liquid waste.

There are a number of hazardous secondary ground effects that can be triggered by earthquakes in addition to the normal ground shaking and ground rupture: liquefaction of soils and sediments; differential compaction of soils and sediments; landslides and rock falls; tsunamis; and snow avalanches. Each is described in the following sections. In addition to natural hazards and earthquakes, there are hazards associated with the destruction of man-made structures during an earthquake event: dam failure; water tower collapse; building damage or collapse; highway or rail damage; bridge damage; canal damage; ski lift damage; and gas, water, and sewer line disruption. Each of these needs to be considered by

designers, specifically in eastern Placer County. Structures previously constructed need to be appraised for public safety.

4. Liquefaction

Liquefaction is a process whereby a cohesionless soil or a sediment that is subjected to vibrations during an earthquake loses strength and acquires a mobility. Shaking of a saturated sediment tends to compact the material with a decrease in volume. The resulting decrease in volume produces an increase in pore-water pressure so the effective shear strength of the material becomes zero. According to Seed and Idriss (1970) their evidence shows that uniformly graded materials are more susceptible to liquefaction than well graded materials. Also, for uniformly graded sediments, the fine sands tend to liquefy more easily than do coarse sands, gravelly sediments, silts, or clays. Because the materials must undergo compaction, the relative density of the material in large part determines the susceptibility to liquefaction.

Duration of shaking is an important factor in liquefaction along the maximum acceleration of ground motions. Model tests in the geological engineering laboratory at U.C. Berkeley provide a theoretical example. The landslide at Anchorage, Alaska, where thin sand lenses in sloping clayey beds underwent liquefaction after 90 seconds of shaking provides a disasterous real life example.

Structures that are erected on sediments that undergo liquefaction during an earthquake may settle, tilt, float, or move laterally depending on physical restraints. Lake terrace deposits on the northwest side of Lake Tahoe dip to the east.

There is no restraint at the upper portions of the beds to prevent lateral spreading to the lake. Where sediments are in enclosed basins, the tendency would be for tilt or settlement to occur.

For any buildings other than residential that are designed to be sited on surficial deposits in eastern Placer County, it is recommended that (1) the total thickness of sediments be cored by drilling; (2) that standard penetration tests be performed in each different sediment layer; (3) that samples be collected for grain size and relative density; (4) that the coring be logged by a qualified engineering geologist; and (5) that the detailed surface and subsurface geology be mapped and interpreted by a qualified engineering geologist.

Generally, all new construction since the Uniform Building Code was adopted in 1955 can be assumed to be earthquake resistant. Hazards are likely to appear in older contruction. It has been experienced that wood frame buildings resist earthquakes well, while unreinforced masonry buildings have low earthquake resistance.

5. Differential Compaction

Settlement or tilting of structures can occur during earthquakes when one portion of a structure is over one type foundation material and the remainder of the structure is founded on another type material. One example is when part of a building is on bedrock in a cut and the remainder of the building is over fill. Another example is when a building is on both dredged fill and lake terrace deposits. Shaking due to the vibrations from an earthquake compact the less dense material more than the other.

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Settlement occurs over the least dense sediments.

Differential compaction potentially may occur in the same materials and areas that are susceptible to liquefaction. In addition, it can occur where mixed foundation types underlie buildings or other structures. Investigation of a site for the possibility of this occurrence would be part of the geologic-soils-foundation study.

6. Landslides and Rock Falls

Earthquake-precipitated landslides or rock falls could occur in four general areas within eastern Placer County: along steep slopes formed on fractured granitic or volcanic rocks, in steep construction excavation slopes, along underwater fault scarps within Lake Tahoe, and on the saturated slopes of earthfill dams.

The first occurrence would be in areas such as along the east bank of the Truckee River where there exists several ancient stable landslides in the steep volcanic bluffs; along steep granitic slopes on the east slope of the Sierra crest such as the one that heads the meadow in Squaw Valley; on steep volcanic slopes in the highland area between Martis Valley and Lake Tahoe; and steep volcanic slopes bordering the north shore of Lake Tahoe.

Steep road excavations occur along the north shore of Lake Tahoe. Excavation slopes for houses occur in a few areas along the north shore and more will be excavated there and in the volcanic highland area to the north as building density increases.

Hyne (1973) has described underwater landslide slump structures along what appear to be fault scarps in the bottom sediments of Lake Tahoe. The hazard is not due directly to landsliding but indirectly due to the generation of a wave (tsunami) which could

inundate the shoreline. Such waves have been catastrophic in other parts of the world. In the lake, a greater wave probably would be formed due to rapid movement up or down along a fault. The height of the wave would depend on the velocity and amount of movement and the volume of water displaced. The probable height of a wave is impossible to estimate.

The only earthfill dam in eastern Placer County lies in Martis Valley across Martis Creek. Three major earthfill dams occur within a short distance north in Nevada County. Failure of the Prosser Creek Dam could affect Martis Valley. Several earth-fill dams of P.C.W.A. are constructed in the headwaters of the American and Rubicon Rivers which is sufficiently close to eastern Placer County that the same failure mode may occur. Failure of earthfill dams may occur when the structure is ruptured by an underlying active fault as occurred at the Baldwin Hills Dam in southern California, or when the saturated compacted material on the upstream side of a dam slides or slumps during the shaking of an earthquake. This mode nearly destroyed the San Fernando Dam during the 1971 earthquake and caused damage to Boca and Prosser Creek Dams in 1966. The hazard area is the stream valley and overflow area downstream from the dam.

7. Snow Avalanches

Snow avalanches form where there are steep slopes, abundant snow, a factor of the weather or within the snowpack which produces instability, and a trigger to initiate the movement (Hotchkiss, 1968). Two of the criteria also fit the requirements of ski areas. Known avalanche areas within Placer County are Sugar Bowl, Squaw Valley, Alpine Meadows, and where the snow sheds cover the railroad

tracks south of Donner Pass. Increased development within the mountain areas may identify other hazardous areas. Earthquakes provide a potential trigger mechanism for avalanches in eastern Placer County.

All developers in the High Sierra need to understand and investigate their sites for landslide potential, rock falls, and avalanches -- both earthquake-induced and due to gravity.

F. Reducing Future Seismic Risk

1. Earthquake Design Criteria

If the record of historic earthquakes is assumed to begin in 1850, then the recurrence interval of various magnitude earthquakes can be computed for the 115-year period.

RANGE OF MAGNITUDE	NUMBER	RECURRENCE INTERVAL
7.0+	est. 2	62.5 years
6.0 - 6.9	est. 3	41.6 years
5.0 - 5.9	11	11.4 years
4.0 - 4.9	28	4.5 years
	44	

When this data is plotted graphically with magnitude on an arithmetic scale and frequency (inverse of interval = number per year) on a log scale, the 100-year event is 7.2 magnitude. This value would constitute the "maximum probable earthquake" for the region and would constitute a design earthquake for a 100-year interval.

The maximum credible bedrock accelerations as shown on Exhibit 10 are about 0.3 g around the margins of Lake Tahoe, about 0.4 g in the vicinity of Martis Valley, decreasing south to Lake Tahoe, and between 0.2 and 0.3 g in the vicinity of Squaw Valley. Exhibit 11 explains how the acceleration rate affects the Modified Mercali Scale of earthquake intensity based on average foundation conditions. By referring back to the Exhibit 7, the various effects of maximum credible bedrock acceleration can be determined. The predominant period and duration of California earthquake shocks is shown in tables of Exhibit 12.

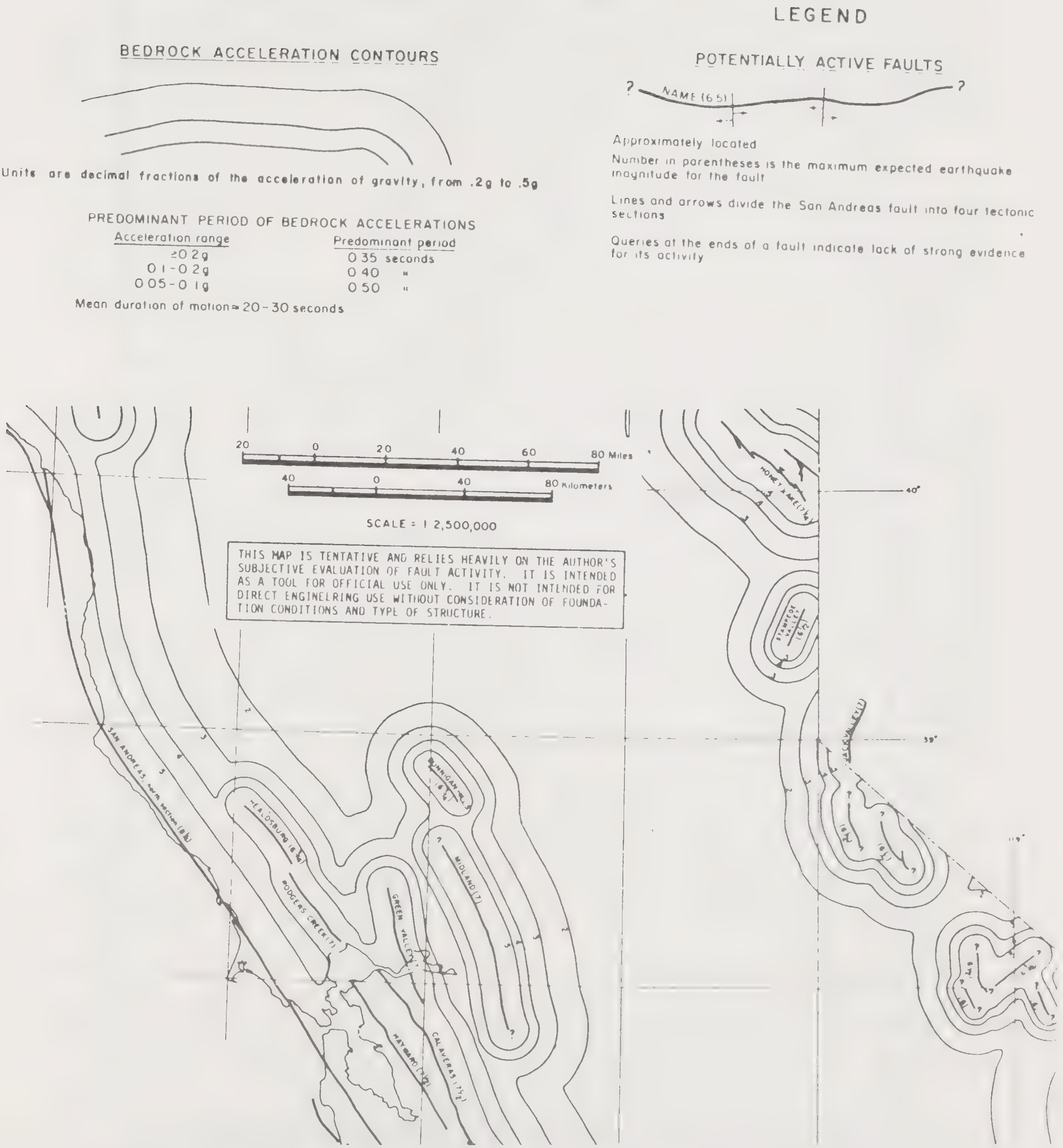


EXHIBIT 10 - Maximum credible rock acceleration from earthquakes (Greensfelder, 1972).

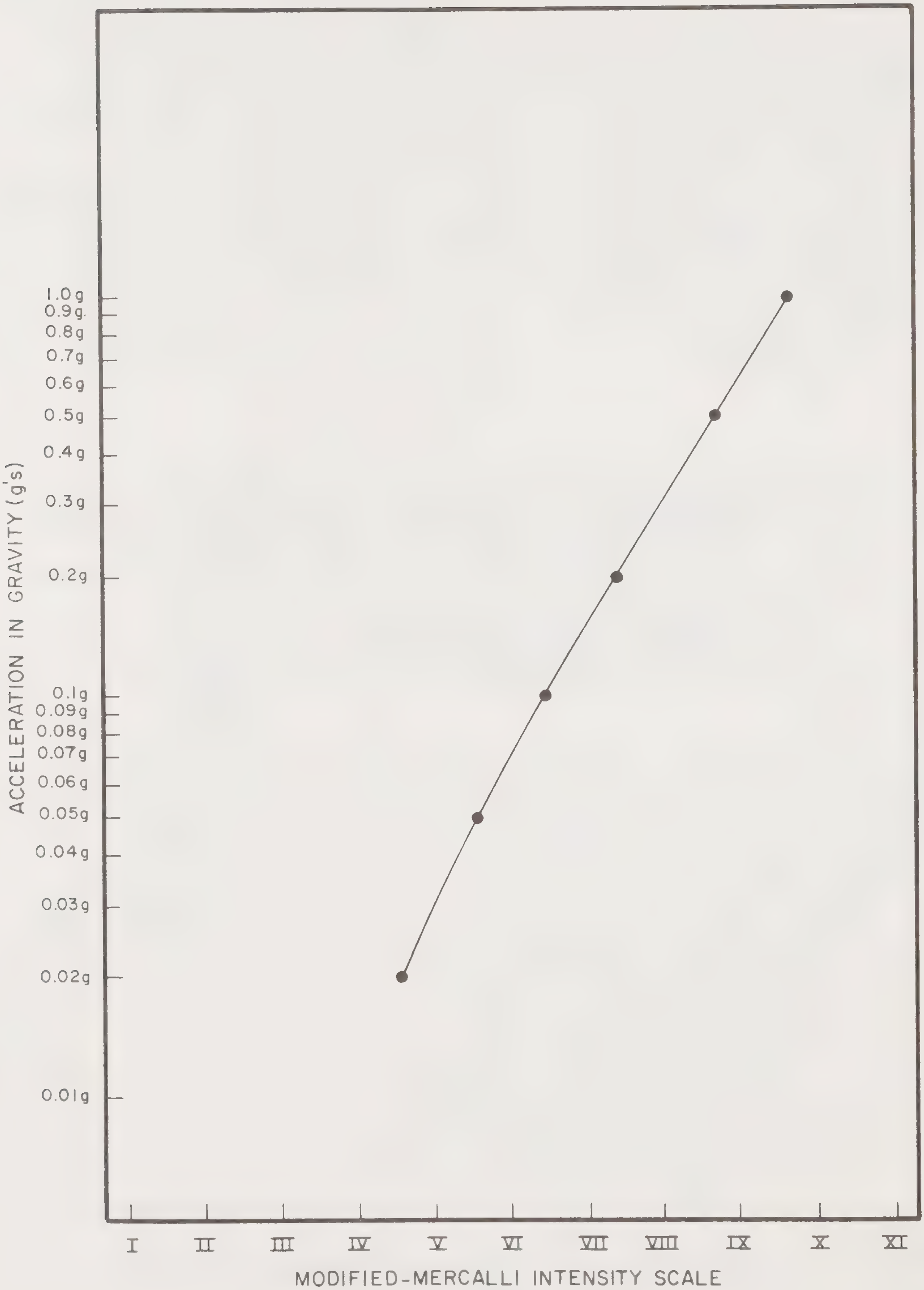


EXHIBIT 11

Earthquake acceleration and intensity related to average foundation conditions

EXHIBIT 12

Predominant period of bedrock acceleration
(data from Seed et al, 1968, figure 7)

Acceleration zone (g)	Fault distance (km)		Predominant period (seconds)
	Range	Average	
0.5	7-14	10	0.35
0.4 - 0.5	10-24	17	0.35
0.3 - 0.4	17-39	28	0.35
0.2 - 0.3	27-63	45	0.35
0.1 - 0.2	47-103	75	0.40
0.05 - 0.1	70-145	107	0.50

Each of these data refers to bedrock reactions. The bedrock effects are amplified in areas of saturated and poorly consolidated sediments so the period of the shock wave generally is greater than in surrounding bedrock. A hypothetical example would be the occurrence of a magnitude 6.5 earthquake along the Stampede Valley Fault. Bedrock acceleration around the north shore of Lake Tahoe would range from 0.2 to 0.3 g. The predominant period would be 0.35 seconds according to the data from Seed shown in the table. However, in the saturated lake terrace deposits overlying bedrock in the same area, the seismic wave period could be amplified depending on the depth ot bedrock, degree of consolidation, ground water level, and slope of bedrock surface. The predominant period could increase to several seconds during transmission from the bedrock to the surface of the lake terrace deposits. When the period of the shock wave is similar to the fundamental period of a building, then internal vibrations and stress generate, which can cause extensive structural damage. The greater the duration of shaking, the greater the damage. The period of a one-story building is about 0.1 second and a 10-story building is about one second. Therefore, low one to two-story buildings might suffer

minor structural damage at North Shore where three-story or higher buildings and structures could suffer considerable damage (Seed and Idriss, 1969). Exhibit 13 defines the urban areas of Lake Tahoe subject to seismic hazards.

The design of earthquake-proof buildings is in the realm of structural engineers. Each construction site within the area would need to be investigated to determine the "design earthquake" magnitude, the bedrock acceleration, the amplification due to overlying soils and bedrock slope. Most sites would require the investigations of qualified engineering geologists and foundation or soils engineers to provide supporting data to the designer.

Each area of surficial deposit may have a different potential for amplification of earthquake shock waves depending on depth to bedrock, slope of bedrock, degree of consolidation, and ground water level. Relatively, the potential for amplification, therefore the construction risk, of the various type deposits is shown in the following list:

	SURFICIAL DEPOSIT	REMARKS
HIGHEST	Lake Terrace Deposits -	Highest in winter and spring
	Stream Channel Deposits -	Depends on water level
	Meadow Deposits -	Depends on water level
	Glacial Moraines -	Depends on consolidation and water level
	Glacial Outwash Deposits -	Depends on consolidation and water level
LOWEST	Terrace Deposits -	Depends on depth to water level

In addition to shaking, the surficial deposits composed of saturated fine grained sediments may undergo liquefaction and differential settlement which increase the construction risk on those materials.

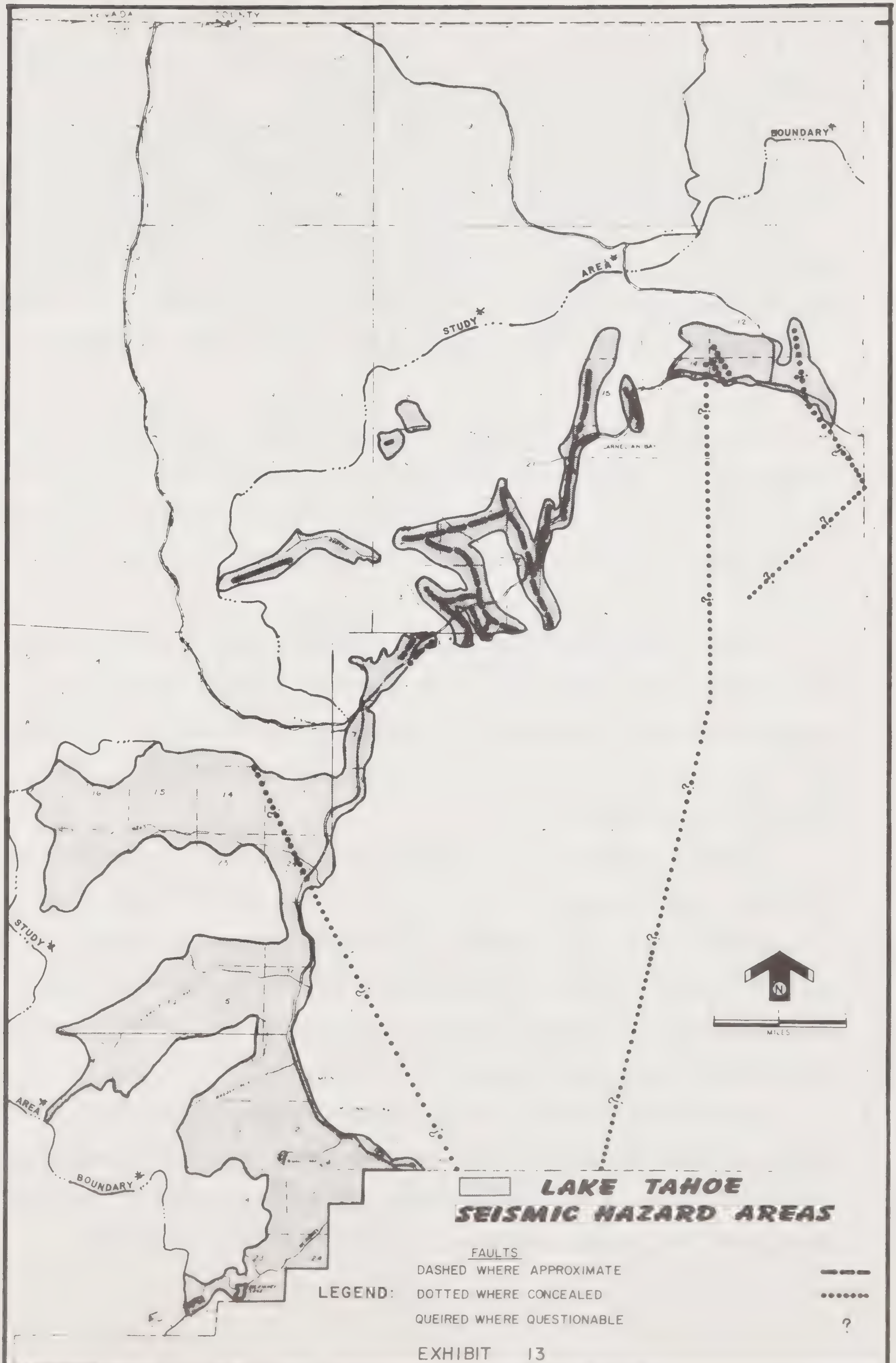

BOUNDARY
AREA
STUDY
CARNELIAN BAY
STUDY
AREA
BOUNDARY
MILES
LAKE TAHOE
SEISMIC HAZARD AREAS
FAULTS
LEGEND:
DASHED WHERE APPROXIMATE
DOTTED WHERE CONCEALED
QUEIRED WHERE QUESTIONABLE
?

EXHIBIT 13

2. Existing Standards for New Construction

In 1955, Placer County adopted the Uniform Building Code (UBC). The initial requirements were for new buildings to be constructed to withstand ground shaking expectable in Zone 2 area (moderate earthquake hazard.) However, in January, 1974, Placer County adopted the 1973 UBC which required that new structures be built to withstand groundshaking expectable in Zone 3 areas (high earthquake hazard).

Currently, all major structural plans are reviewed for seismic loading by the County Building Division. Also, a fee of 7¢ per $1,000 valuation is collected on every building permit. This money is forwarded to the state for use in maintaining a seismic research program.

Placer County has adopted, by reference, the California Dangerous Buildings Code. This code provides a means to review existing unsound structures if complaints are received. Buildings not conforming to existing codes would be required to be rehabilitated or be demolished.

School construction is regulated by the California Field Act of 1933. Enforcement of this act has become quite restrictive since 1967. Geologic surveys of potential school sites and building restriction on active faults were recent requirements. The state currently requires that all schools in use meet adequate earthquake resistance standards by 1975.

Legislative mandate requires that building regulations which apply to hospital construction be more restrictive than school construction since it is required that the hospital must be completely functional to perform services after a disaster. Geologic

investigations are now required on any new construction or expansion of a hospital. The Division of Mines and Geology are commissioned to review these reports. There are currently no regulations for the abatement of existing hospitals not considered earthquake proof.

G. Land Use Planning Criteria

1. Lower Portion of County

The technical information in this report indicates there are no active faults in Placer County. The lower portion of the County, to the Sierra Crest, is considered an area of low earthquake hazard. In-depth seismic studies are currently being prepared around the future Auburn Dam site and preliminary indications are that no active earthquake faults are in the vicinity of the dam. Thus, in the lower part of the County, it appears that no major limitations on land use, housing, or circulation are necessary due to seismic hazards. However, it will be necessary that extreme care be exercised in the construction of the Auburn Dam.

The most critical area of concern in the County is the area east of Donner Summit. There are no active faults; however, they do appear to the north and east. The areas of maximum earthquake severity for ground shaking and secondary effects such as landslides, liquefaction, snow avalanches, etc., would be the alluvial deposits of Martis Valley, the Tahoe lake bed, glacial and stream channel deposits along Lake Tahoe, and the terrace deposits bordering the Truckee River.

All areas in the Tahoe Basin, and especially the areas mentioned above, should be thoroughly studied by structural engineers to determine the design earthquake magnitude of a particular site before development is allowed to occur. This is necessary since each individual site may have a different potential for amplification of earthquake shock depending on slope, depth of bedrock, ground water level, and degree of consolidation.

CHAPTER III

FIRE SAFETY

III; FIRE SAFETY

A. Summary

Placer County has a very serious wildland fire potential as does the entire State of California. The combination of highly flammable vegetation, long dry summers, rugged topography, and people living and recreating in the wildlands, leads to numerous fires each year.

There are many small communities in Placer County built entirely within hazardous forest fuels and are threatened with extensive loss each fire season. As residential and recreational developments continue to encroach into wildland areas, the potential for further loss of life, property, and watershed will increase. Thus, in-depth review must be given to all proposed developments in extreme or high fire hazard areas to maintain the overall hazard at an acceptable level.

The California Division of Forestry (now organized as the California Department of Forestry) Fire Hazard Severity Classification System was used to map the extreme, high, and moderate fire hazard areas in Placer County. The basis criteria used in this system were slope, fire weather, and vegetation. Because of rugged terrain, highly flammable timber and brush covered lands, and long dry summers, the majority of land in the upper part of the County (Auburn to Tahoe) was classified either extreme or high fire hazard area. (Exhibit 14).

There is also a high fire hazard area located along the steep slope of the American River Canyon from Auburn to Folsom Lake. The lower portion of the County can be considered a moderate fire hazard area.

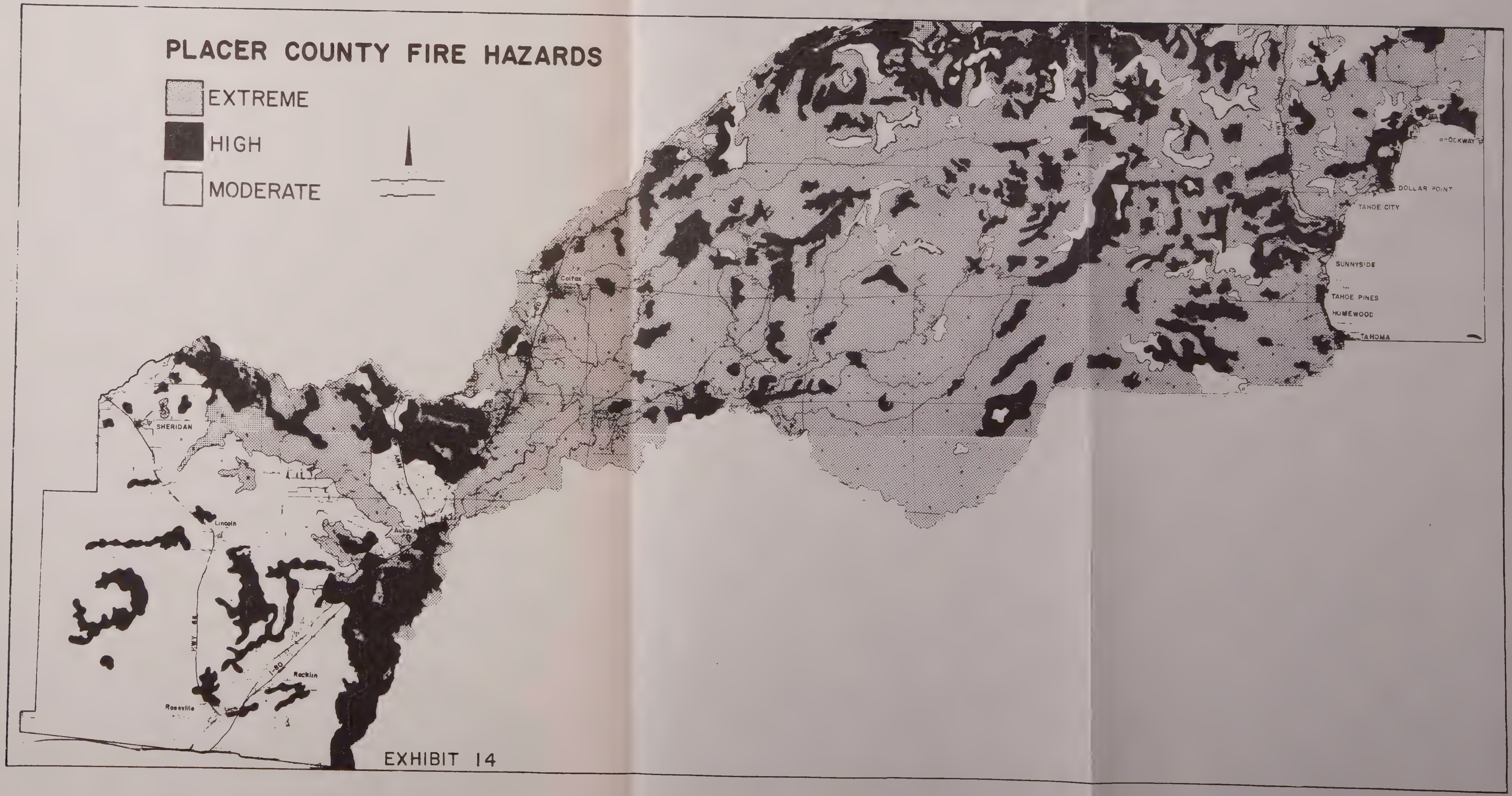

PLACER COUNTY FIRE HAZARDS
EXTREME
HIGH
MODERATE
DOLLAR POINT
TAHOE CITY
SUNNYSIDE
TAHOE PINES
HOMEWOOD
TAHOMA
Colfax
SHERIDAN
Lincoln
Rocklin
Roseville
I-80
HWY 65

EXHIBIT 14

B. Goal and Policies

GOAL: To protect the citizens and visitors of Placer County from loss of life, to protect property and watershed resources from unwatned fires through preplanning, education, fire defense improvements, and fire suppression.

POLICIES:

1. Support the following minumum standards for use and development in wildland areas of varying fire hazards, as determined by the California Department of Forestry's Fire Hazard Severity Scale.

   Extreme and High Hazard Areas - Proposed development should be carefully evaluated for vulnerability to fire and potential sources of ingition. Particular attention should be given to their location, design, and construction materials used in relation to topography, vegetation, and fire defense improvements.

   Moderate Hazard - Strict compliance with state statutes and local ordinances should provide adequate fire protection for any proposed development.

2. Require all new developments to have an adequate water supply for fire needs, and adequate ingress and egress for fire fighting and evacuation purposes before development approval is obtained.

3. Insure that all proposed development in the County be reviewed for fire safety standards by local fire agencies responsible for its protection. If duel responsibility exists, then both agencies shall review and comment in respect to their area of responsibility.

4. Initiate an ongoing program designed to eliminate

structurally unsafe and fire hazardous housing units which are considered reasonable beyond repair or rehabilitation.

5. Insure that existing and new buildings of public assemblage have adequate fire protection measures to reduce the potential loss of lives and property in accord with state and local codes and ordinances.
6. Encourage continued use of education programs in schools, service clubs, organized gourps, industry, utility companies, governmental agencies, press, radio, and television by fire protection agencies to foster public awareness of fire hazards within the County.
7. Encourage and promote installation of smoke detectors in existing residences within the County which were constructed prior to the requirement for their installation.
8. Initiate an agressive program of re-writing, or writing new County ordinances to achieve the goal and policies of this safety element where necessary.
9. Strict enforcement of the Uniform Building Code and the Uniform Fire Code.

C. Definition of Fire Causes

INCENDIARY: (Arson) Fires set willfully and maliciously to burn vegetation or property owned or controlled by such person or property of another.

EQUIPMENT USE: Fires caused by the use of any mechanical equipment other than railroad equipment. This would include welding and cutting equipment, chain saws, tractor, lawn mowers, harvesting equipment, motorcycles, etc.

RAILROAD: Fires caused by railroad employees in the course of their employment, or resulting from construction, operation, or maintenance of railroads or railroad right-of-way.

PLAYING WITH FIRE: Fire caused by playing or experimenting with fire and fire causing agents without malicious intent -- this would include fireworks, model rockets, matches, etc.

ELECTRICAL POWER: Fire caused by an electric company employee in the course of his employment or resulting from the generation, transmission, or distribution of electricity between the point of generation and the final consumer.

CAMPFIRE: Fire started by one or more persons while camping, picknicking, recreating, or working on grass, brush, or forest covered land to provide heat for cooking or personal warmth, light, and for ceremonial or esthetic purposes.

SMOKING: Fire caused as a result of smoking.

DEBRIS BURNING: Fires caused by burning of refuse, slash, etc., or by burning to clear right-of-way, rangeland, etc.

MISCELLANEOUS: Fires caused by events or activities that cannot be logically placed in any of the preceding general cause classes. This would include electrical wiring, faulty flues, cooking,

UNDETERMINED: Fires for which a logical cause cannot be established.

D. Placer County Fire Portection

1. Responsibility

The United State Forest Service (USFS) has basic responsibility for wildland fire protection for all the federally--owned land in National Forests of the County and contract responsibility for the private lands inside the National Forests. All public and private watershed lands outside the National Forests, incorporated cities, and that area west of Highway 65 is provided fire protection under statute law by the California Department of Forestry.

Individual fire districts within Placer County have primary responsibility for all structure fires within their jurisdications. Local government has the basic responsiblity to provide structual fire protection. This need is met in three manners; the city fire department, fire districts, and areas outside cities and fire districts of western Placer County receive structual fire protection from the California Department of Forestry under contract from the County.

Incorporated cities have total responsibility for both structural and wildland fires within their boundaries. Exhibit 15 illustrates the boundaries of the various fire protection agencies in Placer County.

2. Mutual Aid

The USFS and CDF have a mutual aid agreement with each of the individual fire protection agencies within their area as well as between themselves. This document is called the California Disaster and Civil Defense Master Mutual Aid Agree-

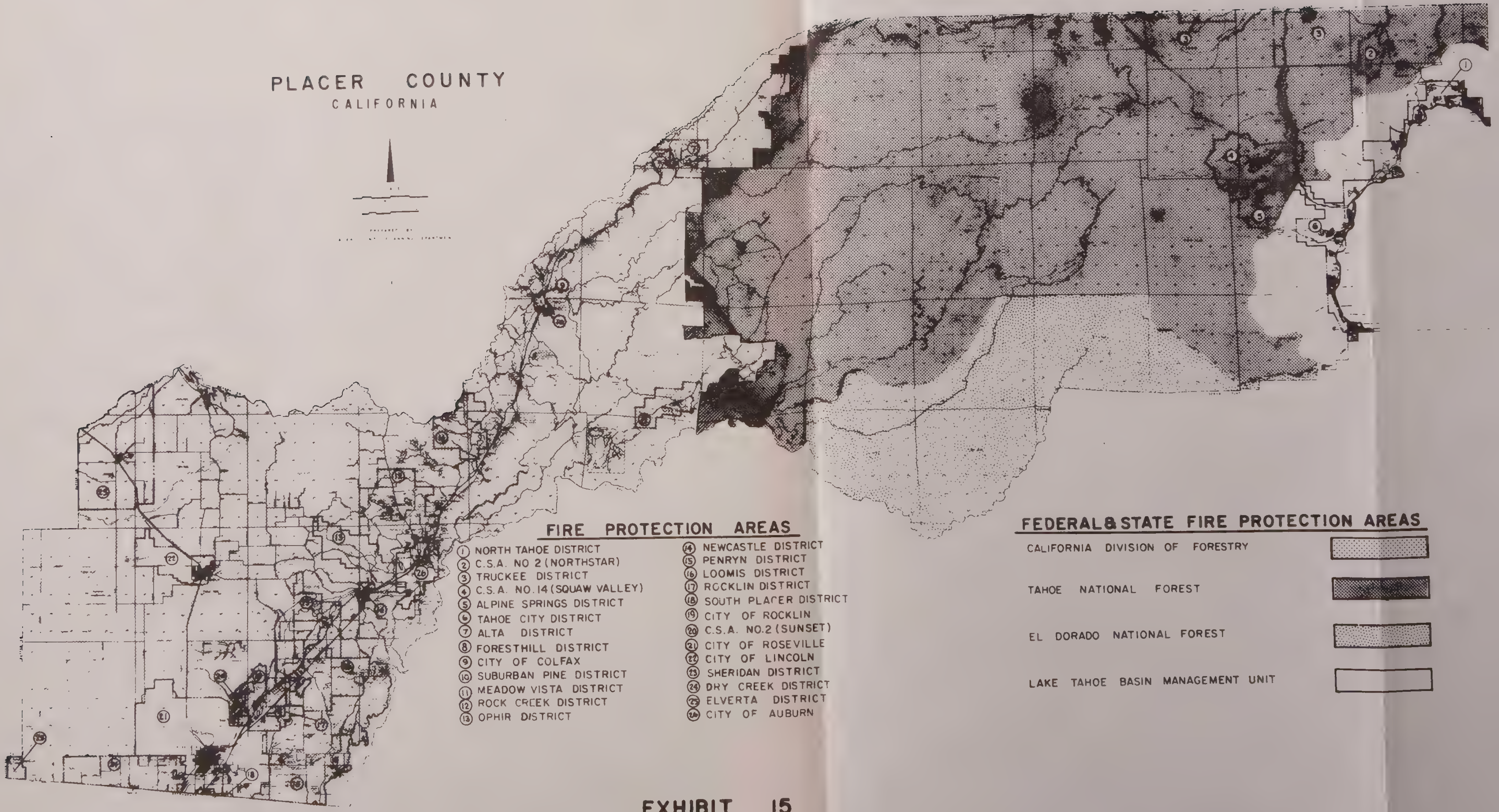

PLACER COUNTY
CALIFORNIA
FIRE PROTECTION AREAS
① NORTH TAHOE DISTRICT
② C.S.A. NO 2 (NORTHSTAR)
③ TRUCKEE DISTRICT
④ C.S.A. NO. 14 (SQUAW VALLEY)
⑤ ALPINE SPRINGS DISTRICT
⑥ TAHOE CITY DISTRICT
⑦ ALTA DISTRICT
⑧ FORESTHILL DISTRICT
⑨ CITY OF COLFAX
⑩ SUBURBAN PINE DISTRICT
⑪ MEADOW VISTA DISTRICT
⑫ ROCK CREEK DISTRICT
⑬ OPHIR DISTRICT
⑭ NEWCASTLE DISTRICT
⑮ PENRYN DISTRICT
⑯ LOOMIS DISTRICT
⑰ ROCKLIN DISTRICT
⑱ SOUTH PLACER DISTRICT
⑲ CITY OF ROCKLIN
⑳ C.S.A. NO.2 (SUNSET)
㉑ CITY OF ROSEVILLE
㉒ CITY OF LINCOLN
㉓ SHERIDAN DISTRICT
㉔ DRY CREEK DISTRICT
㉕ ELVERTA DISTRICT
㉖ CITY OF AUBURN
FEDERAL & STATE FIRE PROTECTION AREAS
CALIFORNIA DIVISION OF FORESTRY
TAHOE NATIONAL FOREST
EL DORADO NATIONAL FOREST
LAKE TAHOE BASIN MANAGEMENT UNIT

EXHIBIT 15

ment which was developed in 1950 and adopted by cities and counties in the state. Under the agreement, each party agrees to furnish resources and facilities and to render services to each and every other party to the agreement in the case of a fire or other disaster. However, no party would be required to deplete unreasonable its own resources, facilities, or services in furnishing such mutual aid.

3. Fire Incidence

All fire suppression agencies in the County are required to compile an annual fire report to the State Fire Marshall. This information was compiled to present the total number of fires in 1975 for Placer County by individual cause. (Exhibit 16)

The leading cause of fires in Placer County in 1975 was incendiary, representing 20.4% of the total. The largest percentage of these fires are normally set during the summer months and occur along the highway and county roads where incendiary devises are thrown from moving vehicles. Incindiary fires in structures are normally set by spreading and ignition of petroleum distillates. CDF reports indicate incendiary fires are increasing at an alarming rate each year.

Equipment use was the next major cause of fires representing 14.9%. One of the major problems in this area is vehicular fires along the highways. Another hazard is the operation of lawn mowers, in dry grass and weeds, and other equipment without the use of spark arresters. Programs have been initiated by the responsible fire agencies to cite violaters. Education programs are being introduced to instruct people on the need and proper use of spark arresters and off road vehicle use in the summertime. Equipment use fires show a 2% decrease from

1974.

Playing with fire represented 12.1% of the total fires in the County. To prevent these fires, the responsible agencies are using inclass programs to educate children to the hazards of playing with fire. This type of fire was up 7% from 1974.

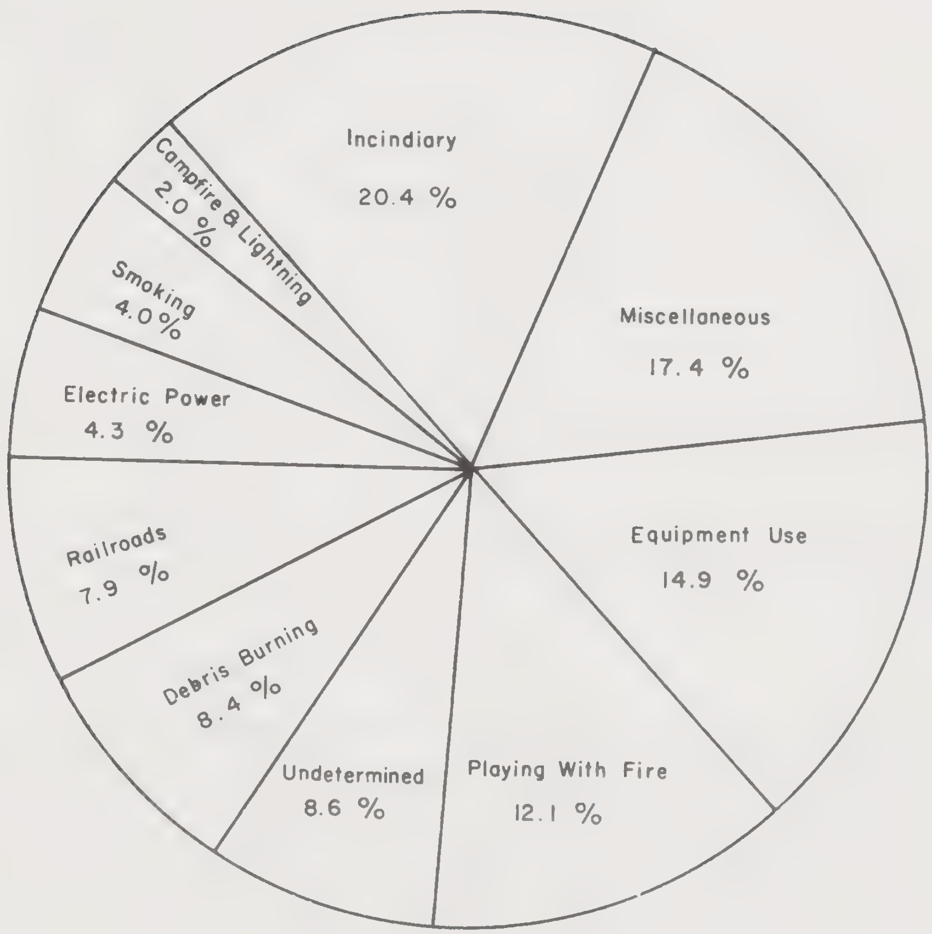
Debris burning caused 8.4% of the 1975 fires. Problem areas include rural communities such as the Loomis Basin and North Auburn. Fire Prevention programs include the requirement of obtaining fire permits, education, discontinuance of burning on hazardous days, and citation in courts of law. This type of fire was up 7% from 1974.

Railroads represented 7.9% of the total fires in 1975. Major areas of concern are steep grades where exhaust carbon on ascent and braking on descent can cause fires. Problem areas from previous years have been pinpointed and a program has been established to fireproof railroad ties and right-of-ways in the problem area. Railraod fires are down 5% from 1974.

Approximately 26% of the total fires had miscellaneous or undetermined causes. The remaining 10.3% were caused by smoking, electric power, campfires, or lightening. Programs to reduce smoking-related fires include distributing printed brochures and having tapes available on safety techniques used in the disposal of smoking materials. Programs have also been initiated with electric power companies for powerline fire prevention as well as frequent inspections in problem areas.

There were very few campfire-caused fires in 1975. The major problem area was along the American River above the Auburn Dam construction site. Special emphasis has been given to patrol of high risk areas.

PLACER COUNTY FIRE CAUSES
1975



Source: Individual Fire Districts Annual Report

EXHIBIT 16

Placer County Fire Causes

Note: There Were 990 Total Fires In 1975

4. Fire Hazard Severity Scale

As mentioned earlier, in order to do effective land use planning, wildland fire areas need first be mapped. Thus the Fire Hazard Severity Scale was used to assign varying degrees of fire hazard to the wildland areas in Placer County.

a. Explanation

A Fire Hazard Severity Scale for California Wildlands was developed in 1973 by the California Division of Forestry. The purpose of the scale is to provide local government land use planners a practical and logical system for classifying and delineating areas of varying severity of fire hazard.

The three criteria used in this classification system are fuel loading (in terms of wildland vegetation), fire weather, and slope.

Fuel loading is divided into light, medium, and heavy fuels which are delineated on U.S. Geological Survey (USGS) topographic maps. Light fuels occupy uncolored areas and represent flammable grass and annual herbs. Medium fuels are shown as "scrub" on the USGS maps and include brush and other perennial shrubs less than six feet in height and having a crown density of 20% or more. Heavy fuels are shown as "woods-brushwood" on the USGS maps and include the heavier brush species, woodland types, and timber over six feet in height and having a crown density of 20% or more.

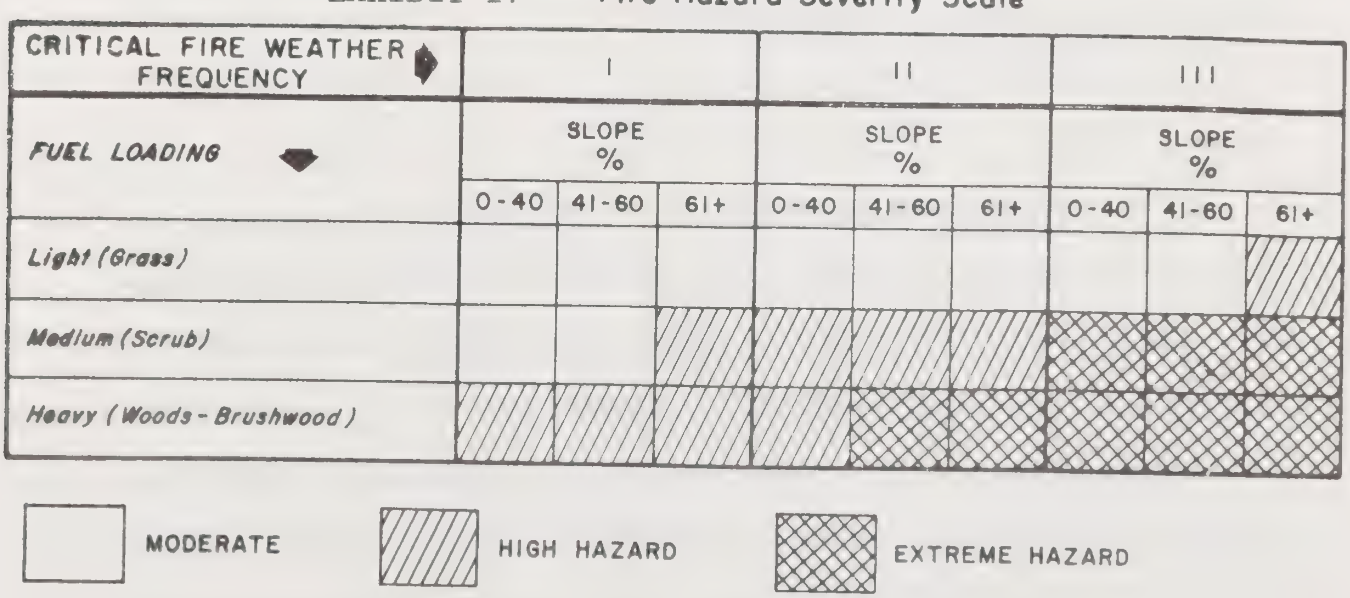
Fire weather is divided into low, high, and extreme classes, depending on the frequency of critical fire weather days occurring in each of the state's Fire Danger Rating Areas.

(FDRA) over a ten-year period. The low class (Class I) includes all those FDRA's which have experienced fire weather in the "Very high" or "extreme" ranges an annual average of less than one day; the high class (Class II) an annual average of 1 to 9.5 days; and the extreme class (Class III) an annual average of more than 9.5 days. Each USGS map on the state has been keyed to the FDRA's and assigned that area's critical fire weather frequency classification.

Slope is divided into 0-40%, 4-60-% and over 60%. Under this rating system, slope is recognized as having a similar effect as wind whereby an increase in slope produces an increase in the rate of fire spread. The system, therefore, assigns values to slope which modify the various fire danger indexes.

Each class of fuel lodaing, fire weather, and slope is assigned a severity factor value and then multiplied in a matrix form to produce a Fire Hazard Severity Scale as shown on Exhibit 17 below.

EXHIBIT 17 - Fire Hazard Severity Scale



b. Hazard Area

Applying the Fire Hazard Severity Scale to the wildland areas in Placer County indicates that there is a serious wildland fire potential in the County. The major area of concern is the mountainous area from Auburn to Lake Tahoe. Due to the rugged terrain, highly flammable timber and brush covered lands, and dry long summers, most of the land is designated either extreme or high hazard. Also, the majority of steep land that drains into Folsom Lake is considered an extreme hazard.

The lower portion of the County is relatively flat with light fuel loading and thus the majority of area is designated moderate hazard.

c. Recommendation

Any proposed development located in an extreme or high fire hazard area shall be carefully reviewed by the County and responsible fire protection agencies to assure that the overall hazard is mitigated through application of policies outlined earlier in this element.

5. Existing Codes and Programs

a. State

i. <u>Fire Safe Program</u>

The Fire Safe Program (FSP) was adopted Marcy 5, 1965, by the County Supervisors Association of California to protect California's valuable mountain resources as well as preserve the natural function of these mountain lands as watersheds in absorbing rainfall needed to produce clear stream flow and water for underground storage.

Because of dry climate, highly flammable vegetation, and

rugged terrain, fire hazard in the mountains is great and fire control is difficult. Increased population in the mountainous areas has caused concern since haphazard development can lead to disaster.

The FSP states that in order to do effective planning and administration of safety requirements, the initial step should be to accurately delineate the fire hazard areas on a map. Once a fire hazards map is prepared, all proposed subdivisions and other developments in the hazard areas should be given coordinated and comprehensive review by local fire, water, road, health, and flood control authorities considering recommended minimum standards stated in the FSP.

ii. <u>California Fire Incident Reporting System</u>

The California Fire Incident Report System was established in 1974. Under the program, the State Fire Marshall's Office receives an annual report on fire incidents from each fire protection agency. This provides a means of obtaining comprehensive fire data on a local and statewide basis. Local fire chiefs should be encouraged to continue to provide accurate data in order that this program might operate effectively.

b. Placer County

i. <u>Uniform Building Code</u>

Placer County adopted the Uniform Building Code in 1955. Periodic revised additions are forwarded to the County and normally adopted by the Board of Supervisors shortly after being received. The most significant change to the code regarding fire safety occurred in late 1973 when smoke detectors were required on all new private dwellings. This amendment was adopted by the Board of Supervisors in 1974.

ii. Placer County Code

Placer County originally adopted restrictions prohibiting the discharge of firearms, explosive, or similar missiles, and smoking in fire danger areas in 1918. In 1925 codes were enacted to require permits for storage of hydrocarbon liquids in the unincorporated areas of the County. Then in 1961, restrictions requiring fire breaks around all buildings, requiring burning permits during the fire season, and prohibiting sale and discharge of dangeroud fireworks were adopted. Finally in 1967 a County Fire Coordinator position was created to assist, advise, and coordinate all fire districts and city fire departments within Placer County. Duties of the position include aiding in enforcing all laws and ordinances adopted by the State of California or County of Placer relating to fires or to fire prevention and protection. Amendments to these code sections need to be continually processed to be consistent with new federal and state requirements.

iii. Subdivision Ordinance

The Placer County Subdivision Ordinance has specific subsections that deal with fire protection. For example, depending on specifics some proposed subdivisions are required to have adequate water capacity to meet the flows and volume required for fire protection as well as domestic use. There are also specific requirements regarding main sizes for fire hydrants in some types of subdivisions. Also, road easements requirements are designed to allow access for emergency vehciles. The fire protection sections of this Ordinance need continual review and ammending to meet the ever increasing fire safety needs of the

CHAPTER IV

FLOOD CONTROL

County.

IV. UNIFORM FIRE CODE

Placer County adopted the Uniform Fire Code in 1975. After adoption the Board of Supervisors amended out of the Code the prohabition against the use of Safe and Sane Fireworks.

IV. FLOOD CONTROL

A. Summary

Information on flooding in Placer County prior to 1940 is limited. However, from available current reports prepared by the Corps of Engineers and private engineers, it appears the primary flood hazard areas are the Truckee River from Tahoe City to Squaw Valley, Dry Creek and its tributaries in the Roseville-Rocklin area, and the Coon Creek-Auburn Ravine area in western Placer County near the Sutter County line.

Within the next two years, the Department of Housing and Urban Development is anticipating preparing a detailed mapping of Flood Prone Areas in Placer County in conjunction with the National Flood Insurance Program which was established by the National Flood Insurance Act of 1968. This report could reveal other areas that are potential flood problems. However, until this study is complete, Placer County should concentrate its efforts in regard to land use, zoning, and building codes to the historical flooding areas previously mentioned.

B. Goal and Policies

GOAL: To protect the lives and property of the citizens of Placer County from unacceptable risk resulting from flood hazards.

POLICIES:

1. Request Flood Plain Information Studies by the Corps of Engineers in every existing and potential problem area in order to obtain documentation necessary to apply flood plain regulations to these areas.
2. Maintain natural conditions within the 100-year flood plain of all streams.
3. Continue to implement zoning policies which minimize potential loss of property and threat to human life caused by flooding.
4. Review Subdivision Ordinance to insure future development in areas subject to flooding will be consistent with standards designated to eliminate or minimize flood hazards.
5. Develop a grading ordinance west of the Sierra Crest to establish standards for leveling, grading, and excavation activities which may affect natural or man-made drainage patterns.
6. Evaluate potential flood hazards in an area prior to the construction of any type of public building.
7. Recognize the open space provisions of the Williamson Act as a potential means of providing tax relief in some rural areas subject to flooding.
8. Encourage further use of the Federal Flood Insurance

Program in problem areas of the County.

9. Adopt the "Intermediate Regional Flood" (100-year) as developed by the Corps of Engineers as the most reasonable limit to be considered in designing the area of the flood plain to be considered.

C. <u>Definition of Terms</u>

FLOOD: An overflow of water onto lands that are used or usable by humans and not normally covered by water. The two essential characteristics of a flood are the inundation of land being temporary and the land being adjacent to and inundated by overflow from a river, stream, lake, or ocean.

FLOOD PLAIN: Low land bordering a river or stream which is subject to periodic inundation during intense storm periods, becoming a part of the river channel in times of floods.

INTERMEDIATE REGIONAL FLOOD: A flood that could be expected to occur approximately once in 100 years on the average, although it may occur in any year.

STANDARD PROJECT FLOOD: A flood that can be expected from the most severe combination of meteorological conditions reasonably characteristic of the geographical region, excluding extremely rare combinations. It would occur less frequently than the intermediate flood.

flood prone areas in the County. At the present time this has not been done in Placer County. According to HUD officials' priorities, it will be approximately two years before the study is initiated for the unincorporated areas of the County with another two years for the study to be completed. All the incorporated cities except Colfax are currently in the program. Once the flood prone areas are determined, communities so designated which do not wish to participate in the Flood Insurance Program cannot receive loans for any construction activity if the lender has any connection with any federal agency. The effect of the requirement is to guarantee that all communities with any flood hazard will participate in the program. It also prevents development within flood hazard areas unless the development is floodproofed. Also, existing structures in flood hazard areas which are damaged by floods must be floodproofed if substantial repair is required.

Until HUD begins work in mapping the flood prone areas in Placer County, the only available flood hazards information will be the studies prepared in Truckee, Rocklin, and Roseville by the Corps of Engineers and the Coon Creek-Auburn Ravine Watershed Study, 1967.

E. Placer County Flooding

1. Truckee River

a. Historic Flooding

The Truckee River Flood Plain Report comprises the area from the Lake Tahoe outlet structure in Tahoe City to approximately one mile below Squaw Valley, a distance of approximately six miles. Information on historical flooding before 1940 is sparce since there were few permanent residences in the area during the winter months. Judging from records, it appears floods occurred as far back as 1862. Past flood records of the Corps of Engineers indicate that floods occurred in Nov-Dec 1950, April-July 1952, December 1955, October 1962, Jan-Feb 1963, December 1964, and June 1969.

The largest flood on record on the Truckee River at Tahoe City occurred in June 1969. The cause of the flood was unseasonable precipitation in June and rapid melting of a deep snowpack with above-normal water content. Maximum releases from Lake Tahoe were necessary to keep the lake at a safe level. Sustained high releases resulted in flooding of residential and commercial properties, destruction of several bridges, and severe traffic disruption. Exhibit 18 illustrates the 100-year flood plain on the Truckee River prepared by the Corps of Engineers.

b. Flood Damage Prevention Measures

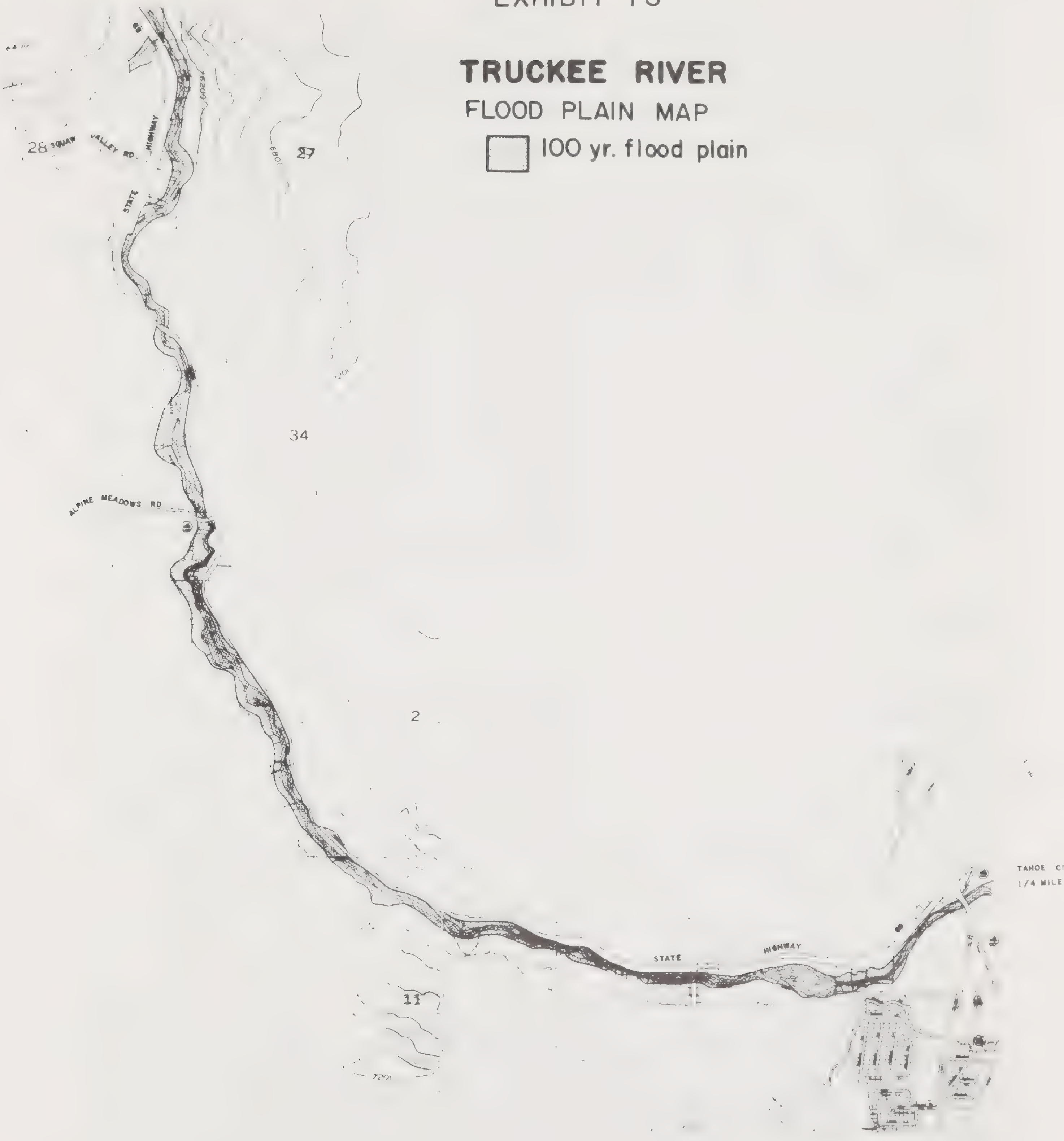
Existing improvements for flood control affecting the study area comprise enlargement of the Truckee River Channel for approximately 3,000 cu. ft. downstream from the outlet structure. This was done to prevent greater lake outflows and alleviate damage along the lakeshore during periods when the lake is at a high level. Areas in the 100-year flood plain are currently zoned "Water

EXHIBIT 18

TRUCKEE RIVER

FLOOD PLAIN MAP

100 yr. flood plain



Influence" which would not permit residential construction in the area. Forecasts of seasonal and short term inflow to Lake Tahoe are prepared by the Joint Federal-State River Forecast Center in Sacramento. These forecasts are used in scheduling releases of the lake. Also, year-round weather surveillance for the Lake Tahoe area is maintained by the National Oceanic and Atmospheric Administration.

There currently is no specific flood fighting or emergency evacuation plan for the area. However, the California Department of Water Resources through its Flood Operation Center coordinates flood fighting activities throughout the state and is authorized to receive requests from local public agencies for assistance during floods.

c. Future Flooding

The large flood that occurred in June 1969 was classed as an Intermediate Regional Flood. On the Truckee River there is a potential frequency of such a flood every 100 years on the average. Flood damages caused by recurrence of known floods would be moderate.

2. Roseville

a. Historical Flooding

There has been frequent flooding along Dry, Antelope, Cirby, North Cirby, and Linda Creeks in the City of Roseville. Records show that there have been an average of a flood every two to three years since 1937. The October 1962 flood was the largest and most damaging in the Roseville area. Over nine inches of rain fell during the storm that resulted in the flood. Creek overflowing occurred throughout the city, but the area most severly affected

was along Linda Creek in the Sierra Gardens Subdivision and along Dry Creek. Numerous streets were unpassable during the flood period.

b. Future Flooding

The most severe floods in the Roseville area occur from prolonged rain. In general, the areas that would be inundated under Intermediate Regional or Standard Projects Flood conditions comprise relatively narrow areas adjacent to the natural channels. The areas of most extensive flooding would occur along Linda Creek in the vicinity of Champion Oaks Drive and upstream of Oak Ridge Drive, around Roger Park, along Dry Creek upstream of Folsom Road, and from Darling Way downstream to the sewage treatment plant.

3. Coon Creek-Auburn Ravine

The major source of flooding in the area is rainfall resulting from cyclonic lows which sweep across California from the northwest. Thunder storms are rare in central California and do not provide appreciable amounts of precipitation.

a. Historic Flooding

Documentation of floods in the area has only been in existence since 1955. It is almost certain flooding occurred prior to 1955 and thus it can be assumed that during general flooding in the Sacramento Valley, the Coon Creek-Auburn Ravine Watershed was also flooded. Chronologically from the period 1852-1955, there appear to have been 12 major floods in the area. The area has suffered major flooding at least five times since 1955.

The main damage to the area is the agricultural losses. Crops are drowned, fences washed out, removal of topsoil, drowning of animals and poultry, and the destruction of auxiliary equipment

such as rice boxes and irrigation ditch turn-outs. Exhibit 19 illustrates flood plain mapping for western Placer County prepared by the Corps of Engineers.

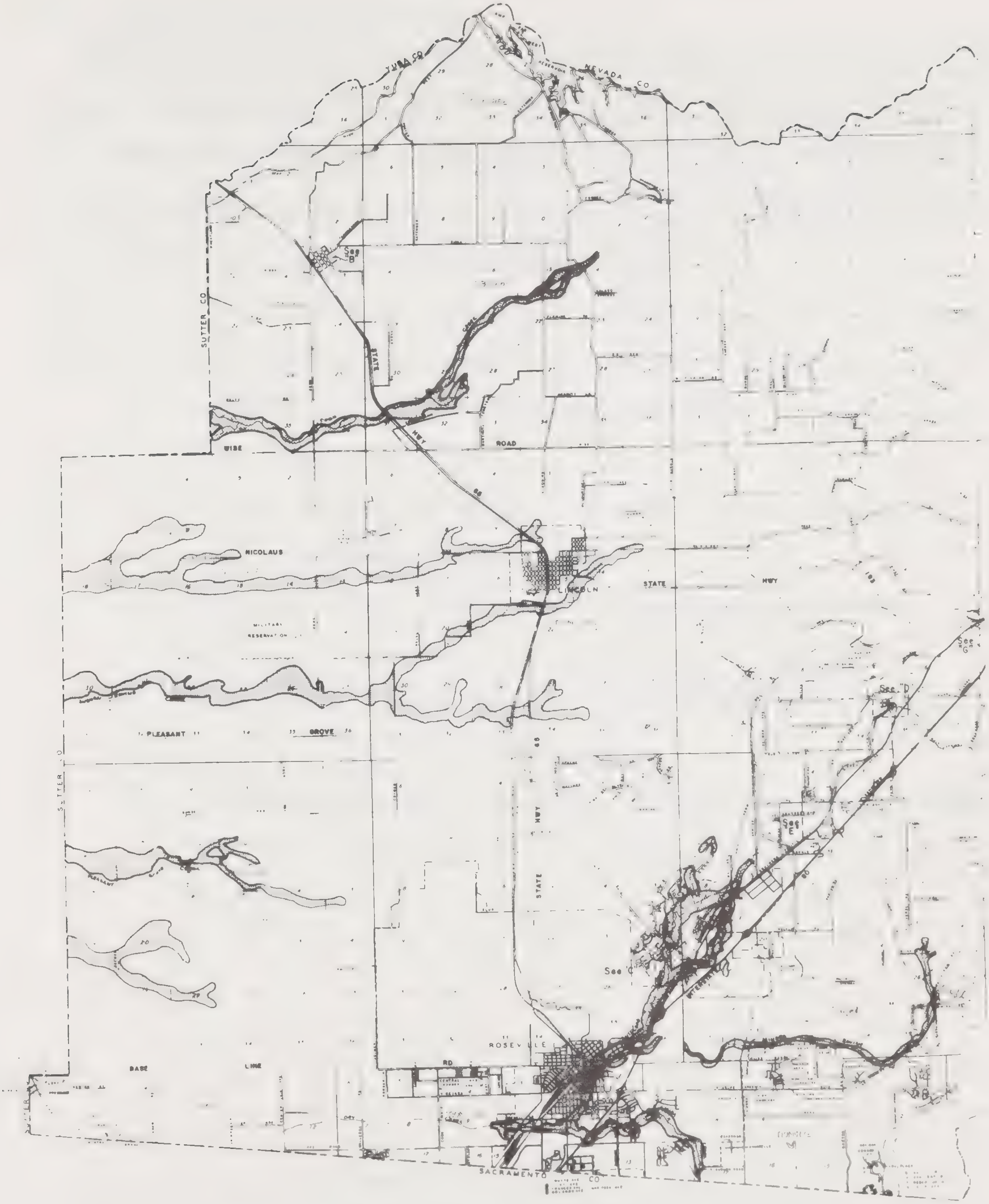
Rain floods, characterized by high peak flow of short duration and relatively small volume of runoff, generally occur in the area during the period November to April, and flood normally passes within a few days. Flood producing rainstorms cannot be accurately forecast and thus reservoir storage space for the control of rain floods must be available at all times up to the end of the rainy season.

Snow melt floods are caused by the gradual melting in the spring and early summer of snow and ice which have accumulated during the winter in the high mountains. This delayed run has been of great value to the Central Valley, enabling the direct diversion and use of water for irrigation and other purposes for a longer portion of the summer season than would be otherwise possible. Snow melt runoff does not cause flooding in the Sacramento Valley, but on the San Joaquin River and its main tributaries as well as the Delta region, prolonged high stages occasionally inundate lands during part of the growing season and cause seepage through levees.

b. Flood Control

Present flood control in the Central Valley is provided almost entirely by means of levees which convey floodwaters past the overflow areas. Studies have shown that in nearly all areas this method of protection can advantageously be supplemented by the operation of multiple purpose reservoirs and irrigation channels. Reservoirs are used to store flood flows until they can be released at rates within the capacity of the channel below, or until they

EXHIBIT 19



WESTERN PLACER COUNTY

FLOOD PLAIN MAP

☐ 100 YR. FLOOD PLAIN

* SOURCE: CORP. OF ENG. FLOOD PLAIN AREAS & COON CREEK – AUBURN RAVINE WATERSHED STUDY.

can be used to meet irrigation requirements. Irrigation canals can be used to an advantage in some cases to carry a portion of the flood flows away from the danger zones to areas where the water could be used beneficially.

F. Building Code Amendments

The Uniform Building Code which regulates construction in Placer County does not specifically speak to building standards for flood hazard areas. Currently, precautions are taken by the local authorities to regulate construction in flood prone areas, but nothing is adopted by ordinance. It is felt by building officials that inclusion of standards relative to the local flood situation is needed. Recommended amendments are listed below.

1. Restrict the use of materials that deteriorate rapidly when exposed to water.
2. Prevent flotation of buildings from their foundation by requiring proper anchorage.
3. Establish final floor grade before inspections are made.
4. Require structural strength to withstand water pressure or high velocity of flowing water.
5. Prohibit equipment that might be hazardous to life when submerged, such as chemical storage, boilers, or electrical equipment.

CHAPTER V

EMERGENCY SERVICES

V. EMERGENCY SERVICES

A. History

Placer County has been involved in emergency preparedness planning since 1951, when the first ordinance was adopted declaring the intent to prepare and plan for civil defense and emergency situations. Later in 1955, the County and the incorporated cities established an operational area which was coterminous to Placer County's jurisdictional boundaries. The County coordinator was then designated as the operational area coordinator and assigned responsibility for overall program maintenance. In 1963, Ordinance 590 was adopted which established the County Executive Officer as the Director of Civil Defense and Emergency Services and included the position of Civil Defense Coordinator. In 1967, the Placer County Disaster Services Council was created and included the Chairman of the Board of Supervisors, the Director of Emergency Services (CEO) and the Assistant Director of Emergency Services. The cities of Roseville, Rocklin, Lincoln, Auburn, and Colfax have passed similar resolutions or ordinances and contract with the County for planning guidance and program assistance.

B. Role

The Placer County Office of Emergency Services is the designated agency with responsibility for planning and coordinating the County's emergency preparedness program. The primary role of this office is to insure that an overall Emergency Operations Plan (EOP) is developed and continually maintained. The EOP contains basic response plans and contingency plans for major emergency or disaster situations that might occur within our jurisdictional boundaries. The conceptional and operational framework for the Office of Emergency Services is that of providing coordinating staff assistance which is fully integrated into the existing governmental structure.

This approach insures that all existing departmental resources and expertise are identified, coordinated, and then applied to an emergency in the most compatible method. It also requires that department personnel become involved in emergency planning for their areas of responsibility and continue to update their procedures and contingency plans.

All special districts, public and private utilities, and private enterprises having valuable resources are also included in the County's emergency plan. These agencies would provide representatives to help coordinate the activities and efforts of their organizations.

C. Work Program

As mentioned previously, the primary role of the Emergency Services Office is to update and revise the County Emergency Operations Plan and the EOP for the five incorporated cities. This is an ongoing function which will be worked on during the coming year. Listed below are other programs and future planning projects to be given priority in the fiscal year 1976-77.

1. Emergency Operations Center

Development of an Emergency Operations Center that is located at Building 7, Dewitt Center. This facility would become the command center for operations in any emergency or disaster. The EOC, when activated, would have representatives from law enforcement, fire, health, public works, transportation, welfare, and others, depending on the situation. This would then become the point where all directions and decisions would emanate. Eventually, this facility will have all necessary furnishings and equipment for the various response units and departmental representatives. Furthermore, communication equipment will be installed to provide the capability for constant two-way radio communications with law enforcement, public works, state emergency services, and others.

2. Dam Failure and Evacuation Plan

Dam Failure and Evacuation Plan represents a program to be given major emphasis this year. This requires that all dams with any development directly within a flood path must be surveyed, analyzed, and, if necessary, evacuation planning and mass care planning must be accomplished. Placer County is quite fortunate in this regard, in that we have had very limited seismic activity and also have few dams with any development below them. Presently,

it appears that approximately eight dams will require some type of evacuation planning, with only two of those needing major evacuation plans. It is estimated that this program will be completed this fiscal year.

3. Hazardous Spill Plan

One of the unique characteristics of Placer County is that we have a major interstate transportation artery running through this jurisdiction. As such, one of the most predominant threats is the possibility of an accident causing a hazardous spill of either cargo or chemicals. Response to a major chemical spill would require the utilization and coordination of all available resources, and represents a major planning effort. This office will develop such a hazardous spill plan in the very near future.

4. Mass Care Facilities Project

The updating and continued development of the County mass care facilities is also a priority project. These facilities are comprised of schools, churches, memorial halls, fraternal meeting halls, and any other buildings capable of housing large numbers of evacuated or displaced persons. The Welfare Department has primary responsibility in this area and draws heavily upon the American Red Cross for support in providing emergency supplies such as bedding, food, and medical supplies.

5. Nuclear Preparedness Program

One of the most important functions of the Office of Emergency Services is the continued maintenance of the County's Nuclear Preparedness Program. This encompasses activities from identifying shelters and radiological monitoring to pre and post nuclear attach planning. Placer County has now been identified as a host

area and, as such, in the near future planning will be required for handling a great influx of displaced persons and controlling a mass evacuation if necessary.

6. Emergency Telephone Number Program

Another project concerns the coordination, development, and implementation of the state mandated "911" emergency telephone number program. The final plans must be developed by July 1, 1979, and implementation must be complete by December 1, 1984. This program provides a single, toll-free emergency number that ties in with a central dispatch allowing instantaneous relay of requests for assistance to the appropriate public safety unit.

A.

DAMAGING EARTHQUAKES NEAR LAKE TAHOE

DATE	APPROXIMATE EPICENTER	ESTIMATED MAGNITUDE	INTENSITY NEAR EPICENTER *	DAMAGE AND INTENSITY
Mar. 15, 1860	Western Nevada	[illegible].5	VIII	Shaking was very violent in Carson City. It was felt over 250,000 sq. mi.
Dec. 27, 1869	Western Nevada	7+	IX	This shock probably occurred near Virginia City where brick buildings were damaged. Damage also reported at Steamboat Springs, Genoa, and Carson City.
Jan. 24, 1875	Mohawk Valley	5.5		The shock was felt at Oroville and Downieville. Turner reported that ground displacement occurred near Wash post-office.
June 3, 1887	Western Nevada	5.5	VII	This shock occurred near Carson City. Stone and brick walls were cracked in the town.
June 22, 1909	Sierra County	5	VII	The most strongly shaken region centered south or southeast of Downieville. Chimneys were damaged at Downieville. Aftershocks continued for 10 days.

* Modified Mercalli Intensity Scale

A (Continued)

DAMAGING EARTHQUAKES NEAR LAKE TAHOE
(continued)

DATE	APPROXIMATE EPICENTER	INTENSITY NEAR * EPICENTER	DAMAGE AND INTENSITY
April 24, 1914	Western Nevada	5.5 VII	Four chimneys at Univ. of Nevada and other chimneys in Reno were toppled.
April 9, 1930	Near Lake Tahoe	4+ V	Plaster cracked in buildings near Lake Tahoe.
June 25, 1933	Western Nevada	5.5 VI	At Virginia City, the church was badly damaged. A number of chimneys were destroyed and some walls were cracked. At Tahoe City, Plaster cracked on some walls. The intensity was V (MM).

(Table reproduced from Wolfe, 1968)

* Modified Mercalli Intensity Scale

A. (Continued)

INSTRUMENTALLY LOCATED EARTHQUAKE EPICENTERS NEAR LAKE TAHOE

LATITUDE DEG	LATITUDE MIN	LONGITUDE DEG	LONGITUDE MIN	DATE MO	DATE DAY	DATE YR	QUALITY*	MAGNITUDE
38	43	119	44	12	20	42	B	4.5
38	44	120	41	12	17	42	C	5.5
38	48	120	06	8	6	37	D	4.5
38	49	119	59	3	22	53	A	5.0
38	49	119	59	3	22	53	B	4.3
39	00	119	54	3	23	48	D	4.6
39	02	119	42	10	2	62		4.3
39	05	119	57	1	22	51	B	4.8
39	16	120	12	8	21	61	B	4.0
39	18	119	48	11	25	47	C	4.5
39	18	120	12	9	8	47	B	4.5
39	18	120	12	9	8	47	B	4.7
39	22	120	09	4	7	54	B	4.3
39	24	120	10	9	14	68		4.6
39	25	119	47	5	9	52	C	5.1
39	26	120	09	9	12	66		5.8
39	25	120	09	9	14	68		4.5
39	26	120	24	3	30	43	C	5.3
39	28	120	20	5	29	54	C	4.1
39	30	120	00	8	7	44	D	4.2
39	32	119	59	9	26	53	B	5.3
39	33	120	05	12	29	48	B	6.0
39	30	120	05	1	8	49	B	4.3
39	33	120	05	1	20	49	B	4.8
39	34	120	18	10	1	58	B	4.6
39	36	120	18	5	10	47	B	4.2
39	36	120	28	11	18	60	B	4.4
39	37	119	42	10	26	50	C	4.2
39	37	119	48	1	21	51	B	4.1
39	38	119	41	11	10	50	C	4.0
39	40	120	33	6	14	59	B	4.5
39	42	119	48	7	8	49	D	4.5
39	42	120	06	10	30	59	D	4.1
39	42	120	24	6	22	50	D	4.1
39	43	120	12	4	1	59	B	5.6

* Quality: Relative accuracy of plot of epicentral locations.
A - Specially investigated
B - Probably within 5 kilometers
C - Probably within 15 kilometers
D - Very rough

B.

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ACKNOWLEDGEMENTS

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